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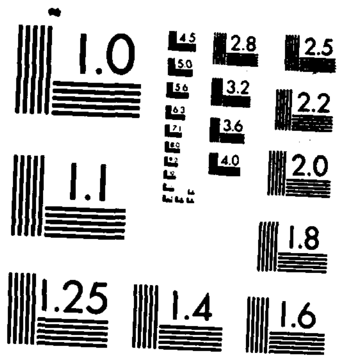


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The HARDMAN methology, as used by the Army, is summarized in this report. The intent of the report is to familiarize the reader with how the HARDMAN analysis is performed. HARDMAN is a front end analysis designed to estimate the manpower, personnel pipeline, and training base impacts of fielding a proposed materiel system. It is designed for use early in the Materiel Acquisition Process (MAP). The resource impacts it estimates are useful in decision-making bearing on supportability and design trade-offs. The estimates are also useful in planning for materiel fielding.



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# HARDMAN

# FAMILIARIZATION

# REPORT

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# HARDMAN Familiarization Technical Report

JAN 1985

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## ABSTRACT

This HARDMAN Familiarization Report (Technical Report) provides a working knowledge of the Army HARDMAN Methodology, including descriptions of required inputs, substeps and the uses of HARDMAN products which will be relevant to the Army weapon system acquisition community and support them in accomplishing their missions. This report is divided into two sections. Section I (Summary Section) provides an overview and summary of the report. Section II (Discussion) contains the read-along materials provided to accompany the HARDMAN Familiarization Briefing to U.S. Army activities; however, this section can also be used as a stand-alone familiarization report for those instances when HARDMAN background information is desired but attendance at the HARDMAN Familiarization Briefing is/was not possible. This familiarization report, therefore, provides greater detail than would be found on the vugraphs alone, but less than that of the HARDMAN Familiarization Briefing script.

HARDMAN FAMILIARIZATION BRIEFING REPORT

TABLE OF CONTENTS


| | Page |
|---|---|
| SECTION I SUMMARY SECTION | 1-1 |
| SECTION II DISCUSSION SECTION | 2-1 |
| HARDMAN OVERVIEW | 2-1 |
| HARDMAN DATA INPUTS/SOURCES | 2-11 |
| ARMY HARDMAN METHODOLOGY | 2-20 |
| HARDMAN OUTPUTS | 2-66 |
| HARDMAN APPLICATION | 2-94 |

## SECTION 1 - SUMMARY SECTION

I. OBJECTIVES: This technical report provides the materials required to present HARDMAN Familiarization to the U.S. Army. The report may be used as read-along material as part of the HARDMAN Familiarization Briefing or can be used as a stand-alone reference to provide background on the HARDMAN Methodology.

II. STRUCTURE: A HARDMAN Familiarization Outline provides for a topical outline of the five areas included in HARDMAN Familiarization. HARDMAN Familiarization is of a general nature to provide knowledge of the six step HARDMAN Methodology. By design, this provides knowledge of the context, content, input, output, and applicability of HARDMAN to the Materiel Developer, Combat Developer and user communities of the U.S. Army. HARDMAN Familiarization is composed of the following topics:

A. HARDMAN OVERVIEW - one module which introduces HARDMAN to the audience and covers the six step methodology at a general level.

B. HARDMAN INPUT/SOURCES - two modules which provide the need for a Consolidated Data Base and the specific input and sources associated with the construction of the Consolidated Data Base.

C. ARMY HARDMAN METHODOLOGY - seven modules which provide an introduction and specific information related to the six step process of the HARDMAN Methodology. Systems Analysis, Manpower Analysis, Training Analysis, Personnel

Analysis, Impact Analysis, and Tradeoff Analysis are the six procedural modules.

D. HARDMAN OUTPUT - seven modules, with six directly related to steps of the HARDMAN Methodology. The modules cover the output of each HARDMAN step as they contribute to the "whole" of the HARDMAN methodology in providing decision makers with information which can be used in the decision making process.

E. HARDMAN APPLICATION - seven modules related to the six steps of HARDMAN. This topic is focused on the examination of a Case History. The Division Support Weapon System/Howitzer Improvement Program was selected to highlight the process, procedures and data output of each of the six steps of the HARDMAN Methodology.

III. HARDMAN FAMILIARIZATION BRIEFING: While the HARDMAN *Familiarization Report can* be used as a stand-alone familiarization document, it can also be used as a read-along reference for the HARDMAN Familiarization Briefing. The topic areas, scopes of each block on instruction, and time allocation for the HARDMAN Familiarization Briefing are shown below:

| TOPIC | SCOPE | TIME |
|---|---|---|
| Overview | TOPIC I HARDMAN OVERVIEW<br>Methodology Overview 1-1 | 50 min |
| Input | TOPIC II HARDMAN INPUT/DATA SOURCES<br>Introduction Module 2-1<br>Organization and Structure Module 2-2 | 50 min |

| | | |
|---|---|---|
| Process | TOPIC III ARMY HARDMAN METHODOLOGY | 100 min |
| | Introduction Module 3-1 | |
| | Systems Analysis Module 3-2 | |
| | Manpower Analysis Module 3-3 | |
| | Training Analysis Module 3-4 | |
| | Personnel Analysis Module 3-5 | |
| | Impact Analysis Module 3-6 | |
| | Tradeoff Analysis Module 3-7 | |
| Output | TOPIC IV HARDMAN OUTPUT | 50 min |
| | Overview Module 4-1 | |
| | Systems Analysis Module 4-2 | |
| | Manpower Analysis Module 4-3 | |
| | Training Analysis Module 4-4 | |
| | Personnel Analysis Module 4-5 | |
| | Impact Analysis Module 4-6 | |
| | Tradeoff Analysis Module 4-7 | |
| Examples | TOPIC V HARDMAN APPLICATION | 50 min |
| | Introduction Module 5-1 | |
| | Systems Analysis Module 5-2 | |
| | Manpower Results 5-3 | |
| | Training Results 5-4 | |
| | Personnel Results 5-5 | |
| | Impact Results 5-6 | |
| | Tradeoff Results 5-7 | |

## SECTION 2 - DISCUSSION

I. HARDMAN OVERVIEW. The goal of the HARDMAN Methodology is to provide timely information on the manpower, personnel, and training (MPT) resource requirements of emerging materiel systems. This information supports:

- o Decisions on the research, development, and acquisition issues affecting emerging systems; and

- o Planning required for effective supportability of these systems in MPT and other logistics areas.

Potential users of the HARDMAN Familiarization Report include general or casual readers seeking only familiarity with the HARDMAN Methodology, users of the information produced by HARDMAN, and the Army management community as a whole. The needs of the above groups were considered during this report's development.

A. MODULE 1. - METHODOLOGY OVERVIEW The HARDMAN methodology is an integrated set of data management techniques and analytic tools. Its purpose is to provide timely and fully documented assessments of the human resource requirements and costs associated with an emerging system's design. Additionally, the methodology provides the capability to determine the impact of a system's manpower, personnel, and training resource demands on the Army's current and/or projected supply of those assets. The result is an early targeting of problem areas in system supportability. Effective tradeoff analyses can then be conducted through iteration of the methodology.

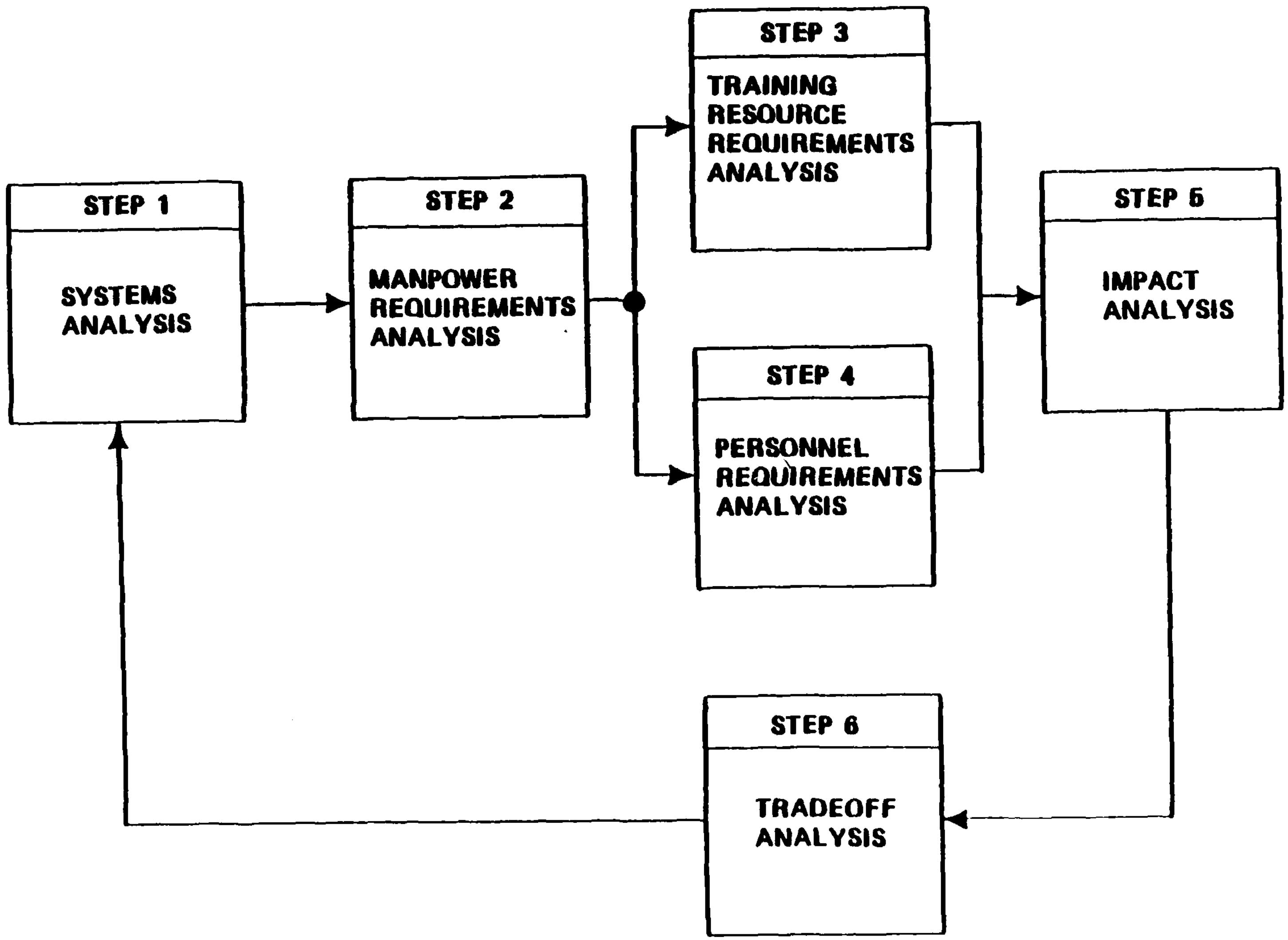
Traditionally, HARDMAN has been represented as a six-step feedback process as shown in Figure II-I. When presented in that manner, HARDMAN was a well-integrated process within each of the six steps. However, it lacked the integration and well-defined procedures needed to move across steps at a level of detail meaningful for individual analysts. This became apparent during applications of the methodology.

In retrospect, the problem seems obvious. Like a game of chess, HARDMAN has a clearly defined beginning ("opening"), middle, and end ("endgame") each requiring a different strategy if the analysis, as with the game, is to be brought to a successful conclusion. HARDMAN's middle, a set of well-defined procedures drawn from industrial engineering, curriculum development, and applied mathematics, determines a system's MPT requirements. The analysis process is relatively straightforward, involving few loops.

In HARDMAN's opening, however, analysts must match the data and information requirements of the MPT processes with that available in the Army as well as the loose definition of the emerging system. Many loops and tradeoffs exist, with each completed part of the process contributing to the completion of other parts. Similarly, at the end of HARDMAN, the impact of the MPT requirements on existing Army organizations and processes cannot be determined without information about the policy and decision environment within which those organizations and processes function. Since the environment is continually changing, the HARDMAN analysis must continually adapt to those changes.

Consequently, the traditional six-step representation can be abstracted into three high-level processes and broken down into a greater number of more detailed substep groups and substeps. The higher-level processes are referred to as

# STEPS IN THE METHODOLOGY

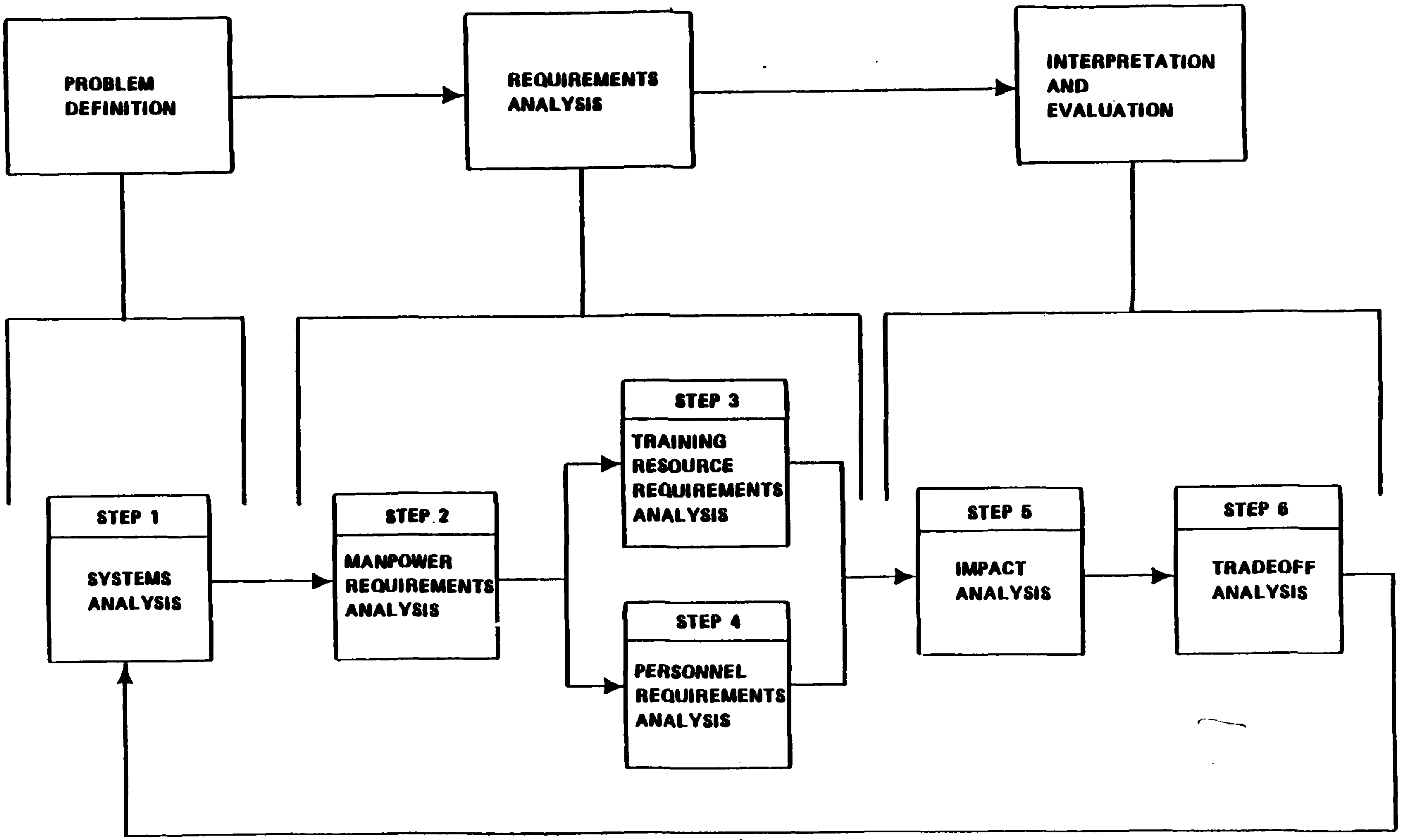


Problem Definition, Requirements Analysis, and Interpretation as shown in Figure II-2. At a lower level, there are fourteen distinct analytic subanalysis processes. These are shown in Figure II-3.

The Mission Area Analysis (MAA) phase of the LCSMM culminates the Army's assessment of its mission needs. If a requirement for a new weapon system emerges from the MAA, it results from perceived deficiencies in the Predecessor System, a system currently in the Army inventory. The MAA determines whether the Predecessor System should be replaced completely or in part. Replacement of the Predecessor is usually advocated in the event of: excessive operation and/or support costs, a perceived enemy threat to which the Predecessor is unresponsive, an opportunity to incorporate technological advances, or any combination of the above. Three types of system acquisition--System Replacement, Replacement System, or a New System--can arise when the new system requirement is compared with the Predecessor System. The distinctions between the three types are important because each has different implications for a future HARDMAN application.

Fundamental functions of the new system requirement are first identified in the MAA. These functional requirements are an expansion of the mission needs, with more specific information about system constraints and environment included. Specific performance goals, if stated, are also included in the system functional requirements. By definition, the Predecessor System is unable to satisfy the functional requirements of the new system. However, functional requirements information available from an MAA usually focuses on Predecessor System deficiencies, not on the full set of functional requirements identified for the new system. The System Functional Requirements Analysis

# STEPS VS. HIGHER LEVEL PROCESSES



# HARDMAN SUB-ANALYSIS

| STEP 1 | STEP 2 | STEP 3 | STEP 4 | STEP 5 | STEP 6 |
|---|---|---|---|---|---|
| SYSTEM ANALYSIS | MANPOWER ANALYSIS | TRAINING RESOURCE REQUIREMENTS ANALYSIS | PERSONNEL ANALYSIS | IMPACT ANALYSIS | TRADEOFF ANALYSIS |
| • Mission Analysis | • MOS/Grade Determination | • Task Comparability Analysis | • Personnel Requirements Analysis | • Impact Analysis | • Tradeoff Analysis |
| • Functional Requirements Analysis | • Workload Analysis | • Course Requirements Analysis | | | |
| • Equipment Comparability Analysis | • Manpower Requirements Determination | • Training Cost and Resource Determinations | | | |
| • Reliability and Maintainability Analysis | | | | | |
| • Task Identification | | | | | |

procedures in HARDMAN are designed to overcome this lack of information.

Comparability analysis derives systematic estimates of the human resource requirements of emerging materiel systems by extrapolating from the known requirements of similar operational systems and subsystems. A comparability analysis converts the functional requirements of the new system into at least two specific but non-integrated system constructs: the "Proposed System" and the "Baseline Comparison System." These constructs are developed by identifying specific hardware components which can perform system-level functions and tasks. Identified components must also meet the design, operational, and support needs implicit in the functional requirements. HARDMAN system definitions are shown in Figure II-4.

The first of these analytical constructs, the Proposed System, may incorporate technological advances likely to exist before the system's projected Initial Operational Capability date. When the analysis begins, one or more alternative Proposed System may be presented. The number presented depends on how many unique solutions were offered by the materiel developer or materiel contractors in response to the Army's statement of mission need and/or system requirement.

Conversely, a statement of a desired system solution may not be available either from a contractor or from the Army via the Best Technical Approach. A HARDMAN application would then develop a composite Proposed System using information from the technological base and the research and development community at large.

# HARDMAN SYSTEM DEFINITIONS

| SYSTEM TYPE | SATISFIES NEW SYSTEM FUNCTIONAL REQUIREMENTS? WHAT | HOW WELL | TECHNOLOGY | STATUS | DATA |
|---|---|---|---|---|---|
| PREDECESSOR | MAJORITY | MANY DEFICIENCIES | EXISTING–OUTDATED/OBSOLETE | DEPLOYED/OBSOLETE DoD/NATO | MATURE |
| BCS | ALL | SOME DEFICIENCIES | CURRENT–STATE-OF-THE-ART | DEPLOYED–DoD/NATO | MATURE |
| PROPOSED | ALL | FEW DEFICIENCIES | FUTURE–EMERGING, NOT DEMONSTRATED | IN DEVELOPMENT | IMMATURE<br>• ENGINEERING ESTIMATES<br>• OT/DT TEST<br>• LAB TEST |

The second system construct is termed the "Baseline Comparison System" (BCS) by MIL-STD 1388-1 (Logistic Support Analysis). The BCS may be a current operational system but is much more likely to be a composite of current operational systems and subsystems. This composite closely approximates the design, operational, and support characteristics stipulated for the developmental system. Components of the BCS may be drawn from the Predecessor System and other comparable existing systems in the DoD/NATO inventory. The degree to which Predecessor System components are included in the BCS depends on whether the developmental system represents a System Replacement or a Replacement or New System. In a System Replacement, some Predecessor and some supplemental components are found in the BCS. In a Replacement or New System, little or no Predecessor representation exists in the BCS.

Historical and projected Reliability, Availability, and Maintainability (RAM) and operator/maintainer task data are then collected for both the BCS and the Proposed System(s). The maturity of the data used for the BCS and the Proposed Systems forms a crucial distinction between the two. To qualify for inclusion in the BCS, a candidate component must have mature data available. Such data is needed to demonstrate the likely MPT impacts under field conditions.

The Proposed System, on the other hand, is defined as being less technologically mature. As such, it can include data from tests or engineering estimates. Differences between the two data sets are analyzed to identify design changes between the BCS and Proposed Systems. Proposed System MPT requirements are then extrapolated from the BCS requirements on the basis of those design differences.

HARDMAN Methodology output focus on manpower, personnel, and training requirements of the BCS and the Proposed Systems. If a Predecessor System exists, output include an analysis of these MPT requirements' impact on resources currently assigned to the Predecessor. This information makes it possible to discriminate among competing system alternatives early in the LCSMM. It also permits MPT supportability to be planned concurrently with system decisions. HARDMAN results also impact on other processes and products in the system acquisition process. While aggregation of HARDMAN results across systems has the potential to provide useful force-level information, either to a proponent or on a total-force basis, HARDMAN's present focus is limited to a single system.

## II. HARDMAN INPUT/DATA SOURCES

A. MODULE 1 - INTRODUCTION. The purposes of the Consolidated Data Base (CDB) are to support HARDMAN requirements analyses, facilitate tradeoffs, provide information for required program reports, and to justify program decisions by providing audit trails for the HARDMAN analysis procedures. The CDB is characterized by being a single, integrated data base which contains explicit assumptions, consistent definitions, and common formats, indices, and data elements. These features allow it to be a communications link for the disparate disciplines which HARDMAN makes use of, and also give the CDB the flexibility to be tailored for individual applications of the methodology.

The CDB should contain all the essential, relevant data required for a particular application of the methodology. However, because the time and resources available for a particular application are usually limited, there must be a balance between too much information and too little. Only the most relevant and essential data should be included in the CDB.

B. MODULE 2 - ORGANIZATION AND STRUCTURE. The HARDMAN methodology is data intensive. Much of its value as a decision-making tool depends on the amount and quality of data available for its analytical procedures. With such a heavy emphasis on data, a real need exists for consolidating, storing, and retrieving information efficiently. The Consolidated Data Base (CDB) provides a structured repository for all the information required to perform a HARDMAN application. Currently, the HARDMAN CDB is a combination of manual and automated methods. Here, "data base" takes on its most generic meaning: a collection

of related data which may have multiple uses and which may or may not be computerized.

The data to be gathered as part of a HARDMAN analysis can be either generic, specific to the system, or specific to the functional analysis being performed. Examples of CDB input are shown in Figure II-5.

A data management structure is a systematic, consistent method of organizing information. The CDB data-management structure provides an ordered, convenient means for storing and retrieving data. Raw input data required by HARDMAN analytical procedures are likely to be received in a variety of different forms - hardcopy documents, magnetic tapes, magnetic discs, and on-line data transmissions. The physical and logical forms of the data may not be appropriate for the analytical procedures. Consequently, either or both must be transposed. The data-management structure enables the analyst to organize input data after their physical and logical differences have been reduced. Key characteristics of the CDB Data Management Structure are shown in Figure II-6.

The data management structure consists of (1) analysis worksheets, on which the information is recorded, and (2) indexing mechanisms which allow the analyst to trace the information flow across worksheets. These two components define the structure of the data base. An indexing mechanism, or key, is a label which identifies a unique set of data. Keys differentiate portions of the data base from other portions. The two primary indexing mechanisms, or keys, used in the CDB are (1) the Functional Group Code (FGC and (2) the Military Occupational Specialty Code (MOSC). The Functional Group Code is a standard indexing system which parcels the materiel system into its functional

# CDB INPUTS

GENERIC REQUIREMENTS

- DoD PUBLICATIONS/SOURCES
- DA PUBLICATIONS/SOURCES
- AMC PUBLICATIONS/SOURCES
- TRADOC PUBLICATIONS/SOURCES
- FIELD COMMAND PUBLICATIONS/SOURCES
- GOVERNMENT/INDUSTRY TECHNOLOGY BASE

SYSTEM SPECIFIC REQUIREMENTS

- ACQUISITION STRATEGY DOCUMENTATION
- PLANNING DOCUMENTATION
- PROGRAM MANAGEMENT DOCUMENTATION
- MATERIEL REQUIREMENTS DOCUMENTATION
- ILS DOCUMENTATION (RAM, TM, ETC.)
- MANPOWER DOCUMENTATION
- PERSONNEL DOCUMENTATION
- TRAINING DOCUMENTATION
- MATERIEL CONTRACTOR(S) STUDIES/PROPOSALS

ANALYSIS SPECIFIC REQUIREMENTS

- IMPACT ANALYSIS
- TRADEOFF ANALYSIS

# DATA MANAGEMENT STRUCTURE

- SYSTEMATIC, CONSISTENT METHOD OF ORDERING INFORMATION
- MOST CONVENIENTLY TIED TO HARDWARE SYSTEM COMPONENT BECAUSE HARDWARE IS ESTABLISHED FIRST IN HARDMAN
- MAY BE:
  - WORK BREAKDOWN STRUCTURE (WBS)
  - WORK UNIT CODE (WUC)
  - EQUIPMENT IDENTIFICATION CODE (EIC)
  - FUNCTIONAL GROUPING CODE (FGC)
  - LSA CONTROL NUMBER

  \+ MILITARY OCCUPATIONAL SPECIALTY CODE (MOSC)

  OR ANY SUBSET/COMBINATION OF ABOVE PROVIDED FIRST REQUIREMENT IS SATISFIED

  - HARDWARE/MATERIEL BREAKOUT BY SYSTEM
  - MPT BREAKOUT BY MOS

systems, subsystems, components/assemblies, and parts. Other codes and terminologies have the same result as the FGC. Among these are the Work Unit Code (WUC), Work Breakdown Structure (WBS), Equipment Identification Code (EIC), and LSA Control Number (LCN). With the exception of combat vehicles, the Army does not have a standard FGC structure for its systems. FGCs encountered by the analyst tend to pertain only to the system under analysis.

The Military Occupational Specialty Code (MOSC) is a three-place alphanumeric code establishing the Military Occupational Specialty responsible for operating and maintaining the system under analysis. Approved MOSCs are obtained from Army Regulations 611-101, 611-112, and 611-201 for Officer, Warrant Officer, and Enlisted personnel, respectively. The FGC is used primarily in the HARDMAN System Analysis, where most of the information and data is directly related to the design alternatives of the system under analysis. The MOSC is used primarily in subsequent HARDMAN steps. Army MPT information is invariably identified by reference to the MOSC. Use of both the FGC and the MOSC occurs in several HARDMAN steps. This overlap allows the MPT results of a HARDMAN application to be traced back to the specific elements of the system under analysis.

Worksheets are forms designed to describe, capture, or summarize intermediate results of HARDMAN analytical procedures. To assist the analyst in monitoring the audit trail, each worksheet should be identified by assigning it a unique combination of the FGC, the MOSC, and the number analysis title of the substep which requires the worksheet. An audit trail is a systematic mechanism for tracking the development of MPT requirements and monitoring changes to the data, assumptions, or procedures which produce the MPT requirements. The audit trail permits

another analyst to replicate and validate the results of the HARDMAN application.

The Consolidated Data Base forms the basis of the HARDMAN audit trail. The HARDMAN audit trail has two principal uses. The first is as a tracking mechanism within each HARDMAN step. The audit trail captures and records changes, updates, and modifications to data sources and elements. Justification for changes in data sources and elements as well as rationale for the choice of analytical procedure are also contained in the audit trail. The second principal use of the audit trail is as a "roadmap" across the HARDMAN analysis procedures. This map consists of the relationships established between and among specific data elements during the course of the analysis. When initial results are obtained and established properly, the map can be followed backward through the analytical procedures to uncover the source of unfavorable MPT impacts. This descriptive application of the audit trail is one generally familiar to Army users.

The "map" may also be traced forward to identify effects of potential tradeoffs designed to reduce these unfavorable impacts. This use of the audit trail is prescriptive because it facilitates establishing, in advance, a priority for tradeoff alternatives according to their expected reduction in MPT requirements. Rather than being a discrete element, the HARDMAN audit trail is a capability to be exercised after the analysis is complete. The critical factor in being able to exercise the audit trail capability successfully is the proper construction of the data-source indexes and the data-management structure. When filled with data, these components of the CDB constitute the HARDMAN audit trail.

A standard HARDMAN application requires data from certain generic categories of data: Mission and Functional Requirements, Equipment, Manpower, Personnel, Training, and Task information. The analysis manager examines these categories and selects elements needed to support the particular HARDMAN procedures to be applied. Lower-level, more detailed data elements are identified according to the level of detail required by each analysis procedure. For example, specific materiel system elements may be analyzed at a high level of indenture or a low one. The training analysis may be conducted at the course level or the more detailed task level. High-level data requirements must be translated into lower-level, more detailed requirements according to the specific requirements of a particular application of the HARDMAN methodology. A representative listing of Government Furnished Information (GFI) used as data input sources are shown in Figure II-7.

Once the detailed data elements needed to support the application have been identified, potential data sources are compiled and the data-source indexes are begun. A data-source index is a table describing the source from which each detailed data element is obtained. Data sources in each index are grouped according to major functional categories. A specific data-source index may be developed for each major step in the HARDMAN methodology. Most of the system-specific information, however, will be reflected in Systems Analysis (Step 1) and Training Resource Requirements Analysis (Step 3).

In a particular application, detailed data-source indexes may or may not differ from the more generic data-source index. On the other hand, these may be potential sources for a particular data element. Sample data products are obtained from each source. The manager and analysts then

# GOVERNMENT FURNISHED INFORMATION (PARTIAL LIST)

EXISTING SUPPORTING REQUIREMENTS DOCUMENTS, IN DRAFT OR IN FINAL FORM.

EXISTING MILESTONE REVIEW DOCUMENTATION, IN DRAFT OR IN FINAL FORM.

*MISSION AREA ANALYSIS DOCUMENTATION TO INCLUDE THE O&O PLAN* AND JMSNS, ETC.

OPERATIONAL REQUIREMENTS OF CD

MAINTENANCE POLICY AND MAINTENANCE SUPPORT CONCEPT

SUPPLY/EQUIPMENT LISTS

PERSONNEL POLICY, EXISTING SKILLS, AND TRAINING CAPABILITIES

ENVIRONMENTAL CONSIDERATIONS

EXISTING LSAR FOR APPLICABLE SYSTEMS (ITEMS) BY PHASE

LOW, MEDIUM AND HIGH INTENSITY SCENARIO DATA

examine each product for relevance and completeness. Data are selected from the source which best meets criteria for CDB inclusion. A comprehensive set of the required data can then be requested from the chosen source.

Incoming information should be sorted by function and type before entering it into the CDB. Received data are already grouped by function because they were provided in response to a data category established earlier. Thus, they can be readily processed and arranged into files to support the study's various analytical needs. Received data probably has not yet been classified by type, either as system-specific data or non-system-specific. System-specific data pertain to the design, employment, manpower, personnel, or training associated with any of the alternatives under analysis. Non-system-specific data include Army/DoD policy and directives that influence MPT requirements for a variety of weapon systems.

The distinction in data classification between system-specific and non-system-specific is important. Proper structuring of the system-specific section of the CDB allows distinctions to be made between the BCS and Proposed System alternatives. Distinctions can also be made within a particular functional area such as manpower, personnel, or training. Also, if unfavorable MPT impacts are due to non-system factors, tradeoffs to reduce these impacts must be pursued outside the scope of the acquisition program. The distinction between data types in the CDB helps determine the source of such impacts.

## III. ARMY HARDMAN METHODOLOGY

A. MODULE 1 - INTRODUCTION. The "HARDMAN Methodology" covers each step of the Army Acquisition Process", from mission area analysis to production and deployment. It also covers the system level design, detail level design and operational and supportability requirements of the development/acquisition activity. The application of the methodology can be used for each phase of the LCSM Model to establish a baseline and requirements to support tradeoff studies, support detailed level design efforts, and evaluate field data and proposed changes as can be shown in Figure II-8. The analytical logic assumptions which form the basis for comparability analyses are that changes in technology are generally-incremental and small and that new systems are refinements of old systems. Finally, the whole system is equal to the sum of its parts. What this means is that a careful analysis of system components will lead to overall total system conclusions. The basic approach in HARDMAN uses the mission area analysis, the results from technology based studies, the specifics of the requirements documents, and contract proposals to established the proposed system(s). The mission area analysis and DoD/NATO inventory provides the information and data necessary to construct the baseline comparison system. The continued collection of data helps to refine the specifics of the system based upon expert opinion and judgment. Finally, the requirements of the proposed system with regard to manpower, personnel and training perspective is provided based on the design differences. This process is shown in Figure II-9. The benefits of comparability analysis is that it is empirically derived, mirrors the cognitive processes of the designers, allows for early specification in significant detail and

# USE OF THE METHODOLOGY

| | | | | | | |
|---|---|---|---|---|---|---|
| DSARC MILESTONE | PRE-0 | 0 | I | II | III | |
| DSARC PHASE | MISSION AREA ANALYSES | CONCEPTUAL | VALIDATION | FULL-SCALE DEVELOPMENT | PRODUCTION | DEPLOYMENT |
| DEVELOPMENT/ ACQUISITION ACTIVITY | SYSTEM-LEVEL DESIGN | SYSTEM-LEVEL DESIGN | SYSTEM-LEVEL DESIGN | DETAILED-LEVEL DESIGN | DETAILED-LEVEL DESIGN | OPERATION AND SUPPORT |
| APPLICATION OF METHODOLOGY | ESTABLISH BASELINE AND REQUIREMENTS | ESTABLISH BASELINE AND REQUIREMENTS | SUPPORT TRADE-OFF STUDIES | SUPPORT DETAILED-LEVEL DESIGN EFFORT | SUPPORT DETAILED-LEVEL DESIGN EFFORT | EVALUATE FIELD DATA AND PROPOSED CHANGES |

# COMPARABILITY ANALYSIS
# THE BASIC APPROACH

DEFINE PROPOSED SYSTEM(S) → DEFINE BASELINE COMPARISON SYSTEM → COLLECT DATA → DETERMINE REQUIREMENTS

- MISSION AREA ANALYSIS
- TECHNOLOGY BASE STUDIES
- REQUIREMENTS DOCUMENTS
- CONTRACTOR STUDIES/PROPOSALS

- MISSION AREA ANALYSIS
- DOD/NATO INVENTORY

- HISTORICAL MAINTENANCE DATA
  - NAVY: 3M
  - AF: 66–1
  - ARMY: SDC
- OPERATOR/CREW

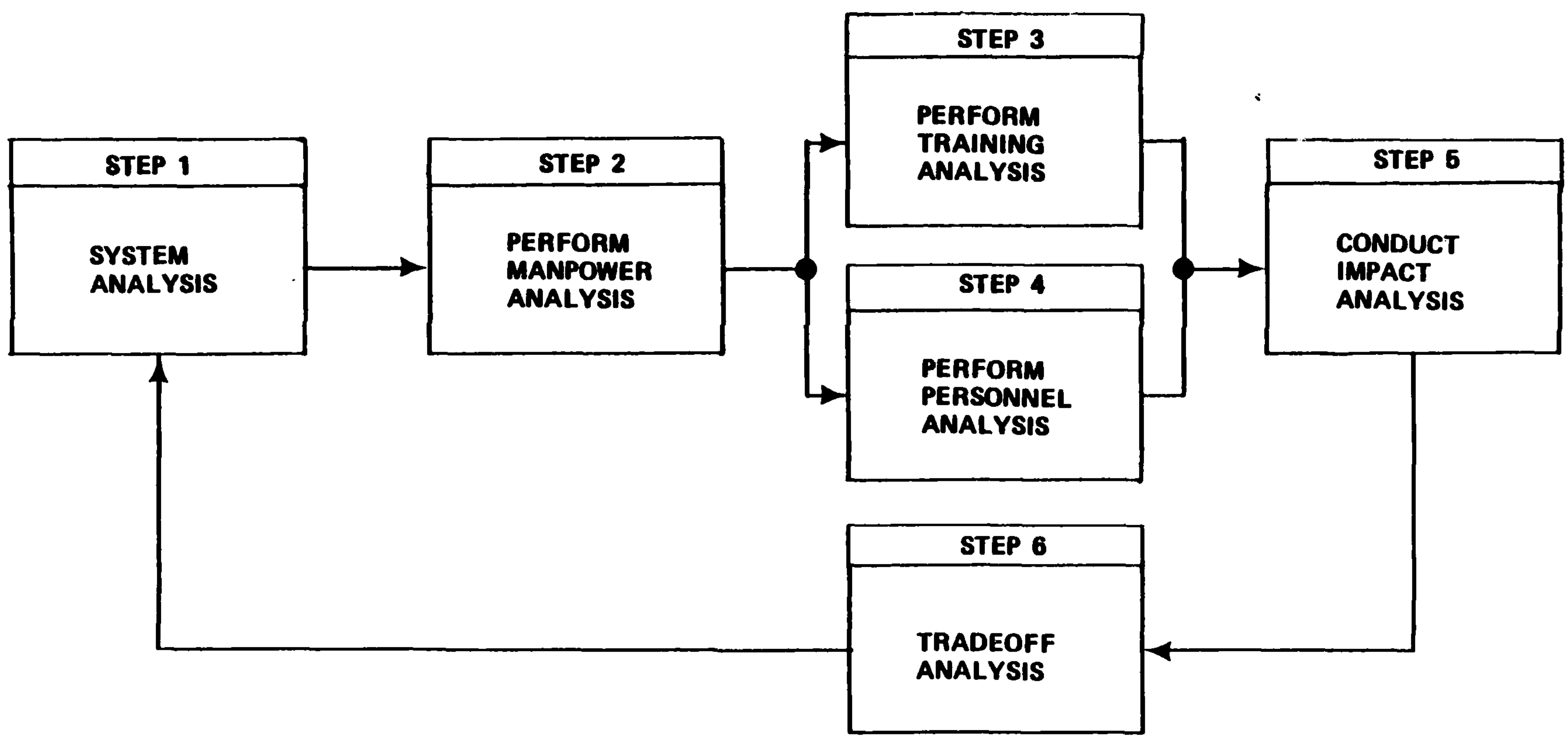
- PROPOSED SYSTEM REQ= f ($\Delta$, BCS DATA)

places the minimum data requirements on hardware developers. The capabilities of comparability analysis thus provide for manpower, personnel and training requirements estimation, a consolidated data base, and a feasible approach for front-end analysis. The steps in the HARDMAN Methodology provide for a comprehensive and interactive approach to achieving comparability analysis objectives. Each of these steps will now be examined in greater detail.

B. MODULE 2 - SYSTEMS ANALYSIS. The six steps in the HARDMAN Methodology are shown in Figure II-10. The first step is entitled Systems Analysis. The major objectives of Systems Analysis are to: (1) determine the range (what) and depth (to what extent and/or how well) of all the functions that the system is required to perform on the battlefield; (2) identify and determine the configurations that accomplish the functional requirements for the predecessor, baseline comparison system and proposed system; (3) quantify the reliability and maintainability parameters for each of the respective system configurations; and (4) specifiy the tasks operators and maintainers of the Baseline Comparison and proposed system will perform.

All this begins with the Mission Analysis. The Mission Analysis derives detailed system usage/activity rates from the general information provided in the statement of the systems missions and environmental conditions under which they take place. Some of these general mission requirements are shown in Figure II-11. At times, this analysis must be conducted "from scratch" or can be a verification of clearly established data from a system. The identification of the mission requirements that a system is designed to accomplish and individual operating requirements is the starting point.

# STEPS IN HARDMAN METHODOLOGY



# IDENTIFY GENERAL MISSION REQUIREMENTS

CLOSE COMBAT (L)

CLOSE COMBAT (H)

FIRE SUPPORT

AIR DEFENSE

COMMUNICATIONS

COMMAND AND CONTROL

INTELLIGENCE AND ELECTRONIC WARFARE

COMBAT SUPPORT, ENGINEERING & MINE WARFARE

COMBAT SERVICE SUPPORT

AVIATION

NUCLEAR, BIOLOGICAL & CHEMICAL

SPECIAL OPERATIONS FORCES

The use of the operational and organizational plan (O&O Plan) and/or the mission profile is central to this analysis. The output or products of this analysis is a listing of general mission requirements and the individual operating requirements which are used in subsequent steps of the analysis process. The analysis is fully dependent upon amount and level of detail available. Examples of the detailed mission analysis guidelines, required input for the detailed mission analysis process and mission profile composition determination are shown in Figures II-12 to II-14.

The <u>functional requirements analysis</u> determines the range and depth of all of the functions that the system is required to perform on the battlefield. Normally, this information is not specified to the level of detail required for analysis in a new system. Usually, only the deficiencies or lack of capability that the new system must address are stated. In theory, the new systems are required to correct the deficiencies of the old (displaced) system to meet and beat the threat. The purpose then is to delineate the question of what is required of the new system on the battlefield in detail sufficient to support subsequent analyses. The objectives of this analysis are to identify the functions required of a system, to examine these functions against the battlefield condition and desired performance, and to allocate the functional requirements to equipment, people or information categories. The inputs include the Battlefield Development Plan (BDP), Mission Area Analysis (MAA), Doctrinal Publications, Operational and Organizational Plans (O&O Plan) and System Requirements Documents (JMSNS, ROC). The products are system functional requirements, functions allocated to HARDWARE, HUMANS, and

# DETAILED MISSION ANALYSIS GUIDELINES

- WHAT ARE THE RELEVANT SYSTEM OPERATING REQUIREMENTS?
- HOW MAY SYSTEM FUNCTIONS BE ARRAYED OVER TIME?
- WHAT PARTICULAR SEQUENCE OF FUNCTIONS IS DESIRED?
- WHAT ARE THE MISSION EVENTS REQUIRED BY EACH FUNCTION?
- WHAT ARE THE TASKS REQUIRED BY EACH MISSION EVENT?
- WHAT ARE THE OPERATING REQUIREMENTS WHICH APPLY TO FUNCTIONS/MISSION EVENTS/TASKS?

# REQUIRED INPUTS FOR THE DETAILED MISSION ANALYSIS PROCESS

- FUNCTIONAL REQUIREMENTS ANALYSIS
- ENGINEERING DATA
- ARMY DOCUMENTATION
  - GENERIC
  - SYSTEM

# MISSION PROFILE COMPOSITE DETERMINATION

- IDENTIFICATION OF SYSTEM FUNCTIONS
- IDENTIFICATION OF TYPES OF MISSIONS
  - RELATED TO SYSTEM FUNCTIONS/END ITEMS
  - RELATED TO OPERATIONAL REQUIREMENT
    - SUSTAINED
    - INTENSE
    - SURGE
- APPLY OPERATIONAL MODE SUMMARY

INFORMATION/SOFTWARE categories. The routines are to review the mission requirements and then identify the system functions associated with that particular mission requirement proposed for the system. The need to list the system functional requirements is addressed at this time to list the attributes or capabilities the components of the system requires in order to carry out their assigned responsibilities. When the system and end item functional requirements are identified, the functional requirements are considered to be allocated to hardware, people and information. The objective of this analysis is to determine which system elements -- hardware, humans, or software (information) - are MPT drivers. The heart of functional allocation is the assignment of functions to the equipment, human or information category. The allocation to equipment first provides for a task taxonomy. Tasks can be equipment or equipment based. Generic and specific equipment tasks can be derived, to develop more specific data at each level of indenture.

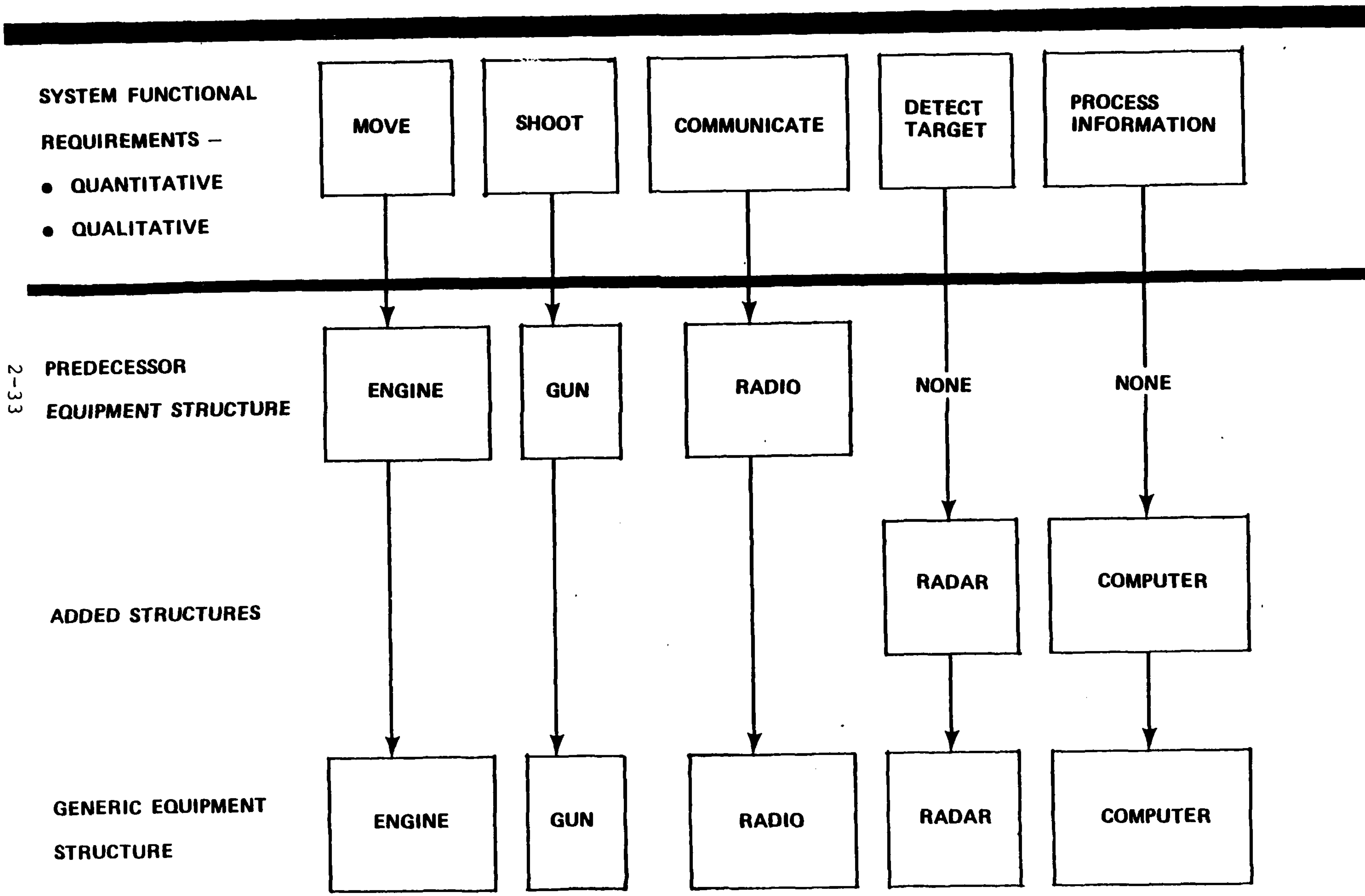
The equipment comparability analysis is the bridge between knowing what the system has to do (functional requirements) and what equipment configurations can do it. The objective of this analysis is to identify a system or component currently in the inventory that is providing the functions that will be provided by the proposed system. The type acquisitions of systems are shown in Figure II-15. Using the list of functional requirements and predecessor equipment list (if the system exists), a comparison will be made to list the equipment required to satisfy each function. State-of-the-art technology is required. If no predecessor system exists, the functional requirements will be used to determine what systems and types of equipment can

# ACQUISITION TYPES

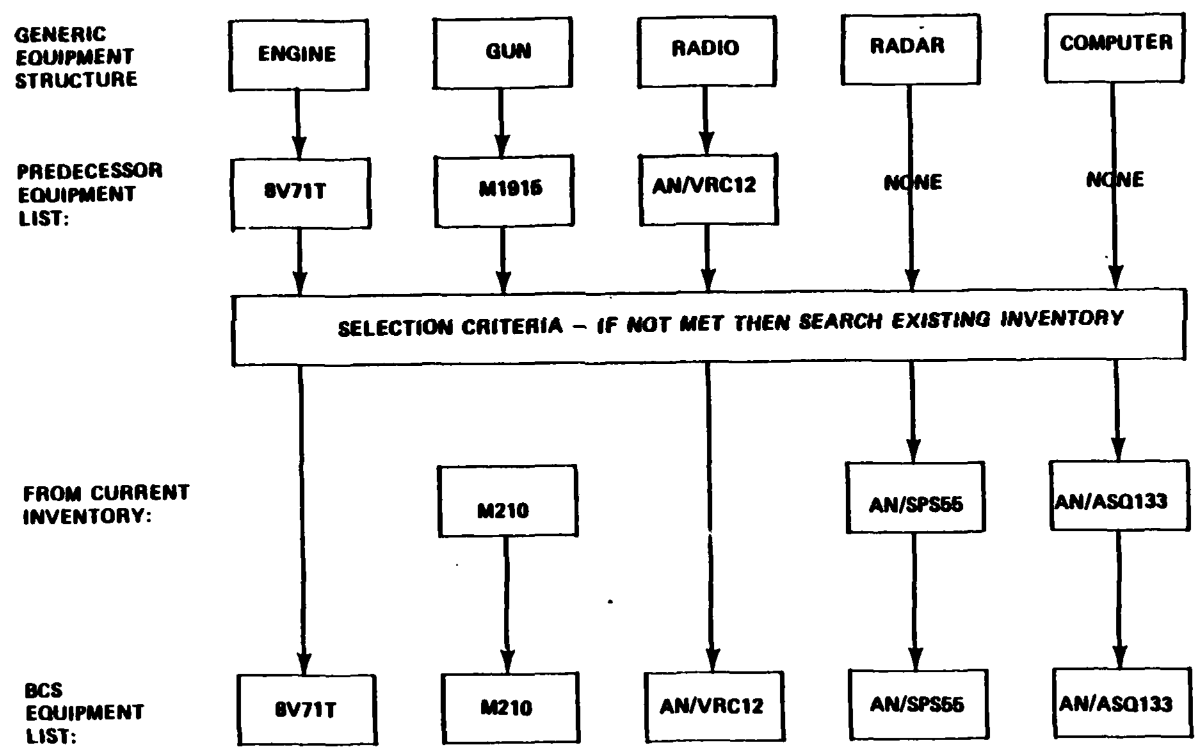
| TYPE ACQUISITION | CHARACTERISTICS | IMPACTS | EXAMPLE PREDECESSOR | EXAMPLE REPLACED BY: |
|---|---|---|---|---|
| Replacement System, | • Replace 1950-60 Version With 1980-90 Version | - Organizational Change: Some/Slight<br>- Personnel: Retrain Crews/Re-Distribute<br>- Doctrinal Change: Some/Slight | M60 A1/A3 | M1 |
| System Replacement | • Replace Old Technology Broadened Operation and Organizational Needs | - Organizational Change: Major Revisions<br>- Personnel: Re-Train Crews/Re-Distribute<br>- Doctrinal Change: Major Revisions | M109 A2/A3 | HIP |
| New System | • A New Capability: Respond to New Threat | - Organizational Change: Establish Organizational Structures<br>- Personnel: Establish Training/Acquire<br>- Doctrinal Change: Establish Employment Doctrine | None | RPV |

accomplish the required functions. This is a generic list and does not cite specific equipment as shown in Figure II-16. The establishment of the baseline comparison system (BCS) is a design configuration to approximate the functional requirements of the proposed system(s) and is shown in Figure II-17. The generic equipment list is used for this routine. The predecessor can provide the generic components for the equipment which still satisfy the functional requirements of the proposed system and the BCS. Unacceptable predecessor equipments which does not meet the mission and functions will be purged. The analysis of the predecessor system is accomplished to determine if the system is suitable in part or total to be incorporated into the BCS. The complete baseline comparison system is composed of all the equipments and components required to meet mission, functional and generic system requirements. It is supplemented by "state-of-the-art" components which satisfy the functional requirements and have available mature reliability and maintainability data to ensure quality control and quality assurance requirements are met. The establishment of the proposed system is the best estimate of the new systems design using advanced technology to fulfill all mission and functional requirements. It should represent the "alternatives" which will fill the bill to counter the threat. This could be a new design, product improvement program, and preplanned product improvement options. This requires the clear understanding of the types of equipment required, an explanation of the performance requirements, and available data concerning the state-of-the-art and new technologies available. A means of identifying this system technology continues as shown in Figure II-18. With the defining of the predecessor system, baseline comparison system, and proposed system(s), a

# GENERIC EQUIPMENT

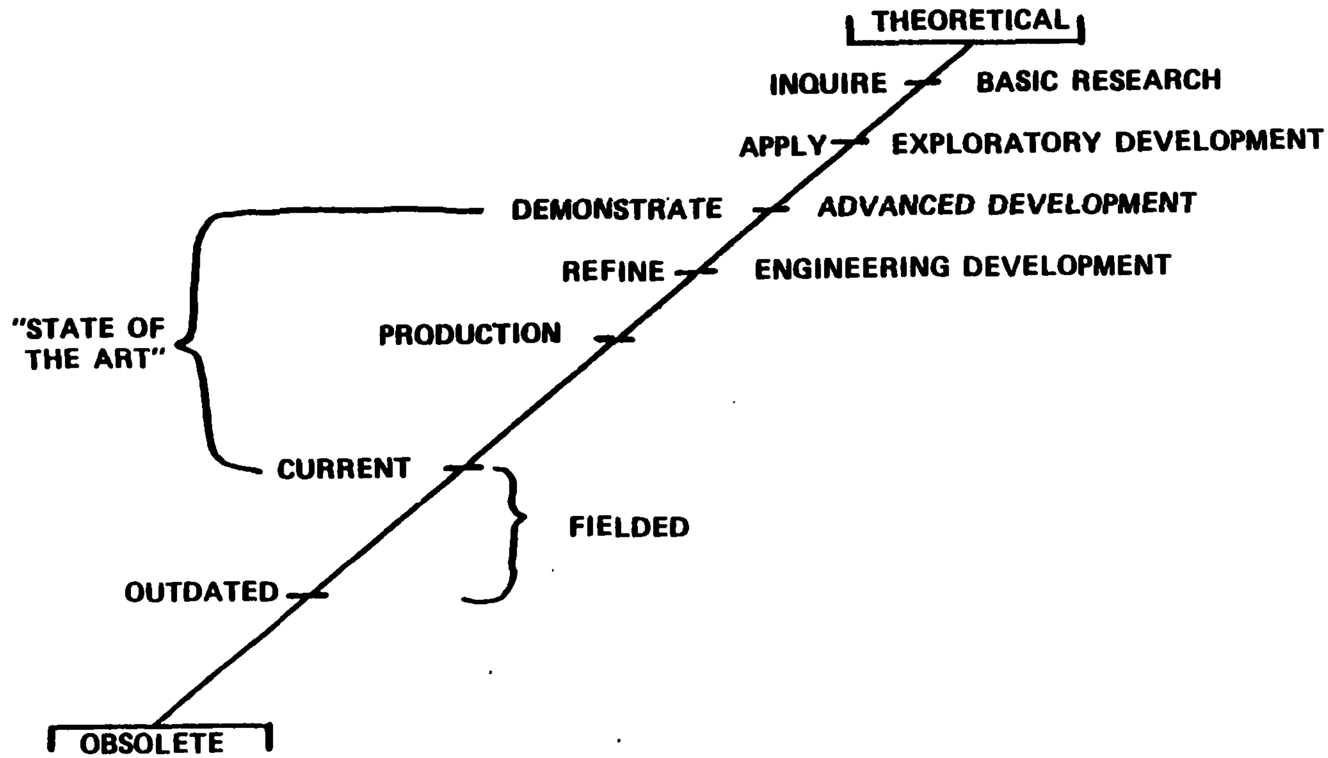


# SELECT BCS COMPONENTS



# DETERMINE DESIGN DIFFERENCES

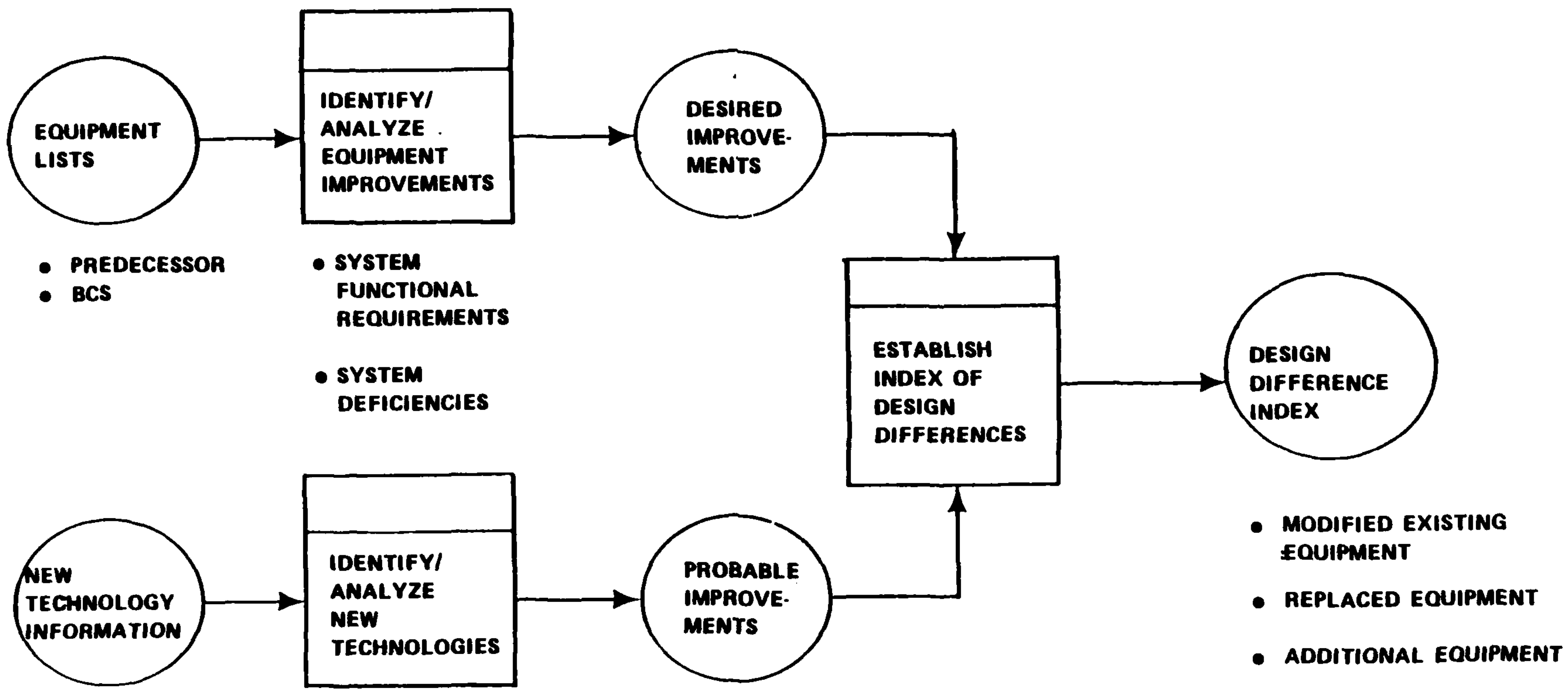
SYSTEM TECHNOLOGY CONTINUUM



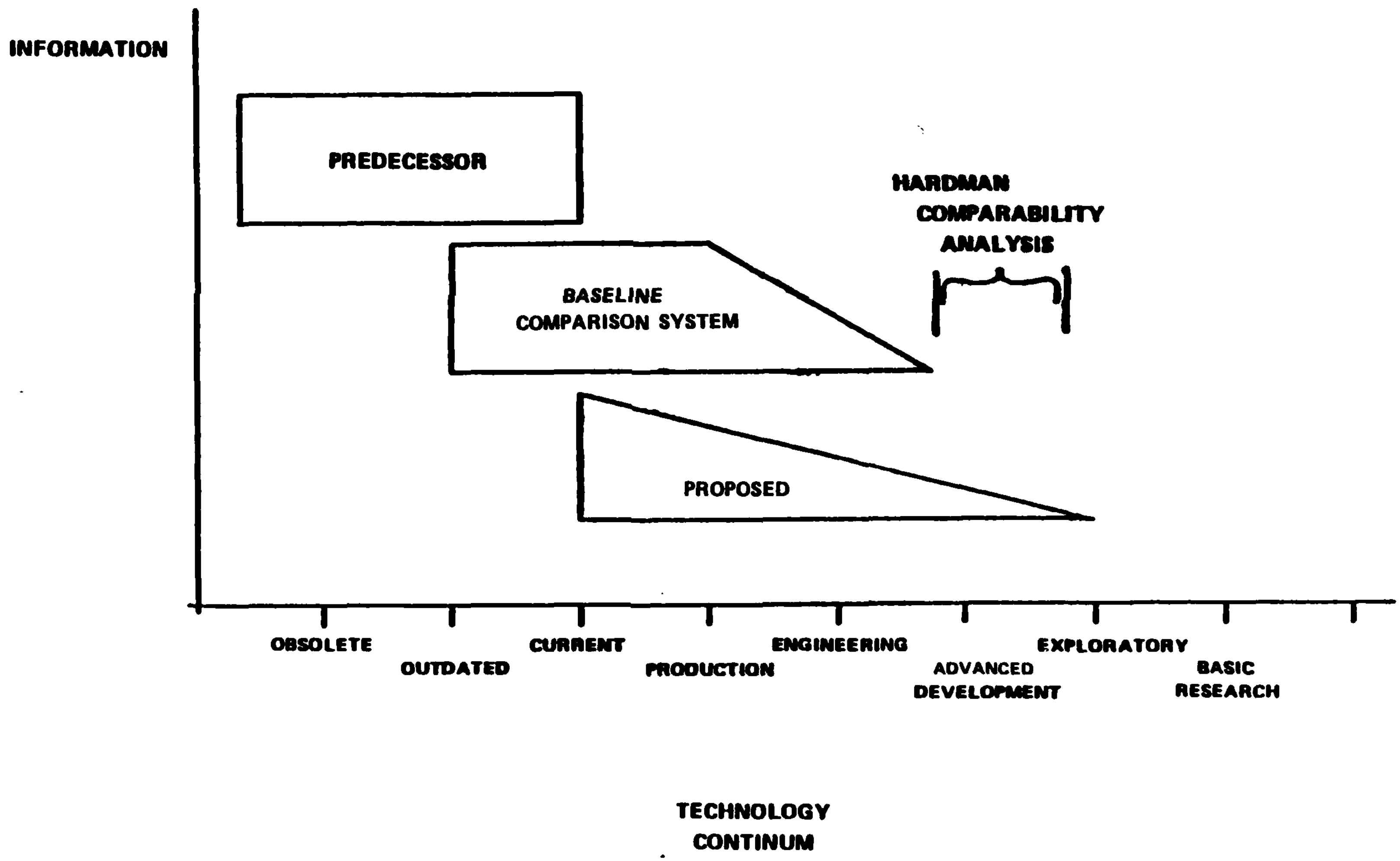
determination of design differences can be accomplished. The procedure is shown in Figure II-19. This provides a means to use the data from existing systems to approximate the proposed system. To complete the design difference list, the BCS equipment list and the proposed system equipment list must be established as shown in Figure II-20. The result of the comparison is the design difference index (DDI). This index can be used to compute baseline comparison system data to fill gaps in the proposed system R&M and performance data. The DDI records for further quantification those design factors which potentially offend MPT resource requirements. The design differences will form the rationale for perturbations of reliability and maintainability values from the baseline comparison system to proposed system(s) comparison. One DDI must be created for each system to proposed system comparison. The gaps where the Predecessor system does not meet the functional requirements are the cues for the development of a DDI. This will aid in the identification of the required improvements. The use of historical data and advanced or new technology available will fill the deficiencies.

The determination of reliability and maintainability (R&M) parameters quantifies the elements of the system design. This provides for the collection of R&M data to generate the workload analysis factors using technical publication, test results, and Army maintenance policies. The determination of equipment metrics provides for an appropriate set(s) of data for use in subsequent analyses. The data must be adjusted as required to process the design difference indexes and norm the R&M data. The characteristics of reliability (the system's measure of the demand for maintenance resources), and maintainability, (the system's

# DETERMINE DESIGN DIFFERENCES



# DETERMINE DESIGN DIFFERENCES



requirements for manpower resources based on prescribed maintenance procedures), are shown in Figure II-21 and II-22. Extrapolating R&M values from the BCS based on the DDI, generates an estimate of the workload requirement for the proposed systems.

Using the wide array of inputs generated by previous routines, the task identification step is conducted to identify the task taxonomies for each of the baseline comparison system and proposed system(s). The result of this activity is a listing of tasks matched to end items, major systems or subsystems. Also, the baseline comparison system and proposed system(s) maintenance tasks are matched to appropriate levels of equipment indenture. The top down analysis approach provides with system missions and moves in an iterative order through successive levels of function(s), equipment(s) and task(s). Each level of indenture is defined in greater detail. This approach provides for classification of human task .relationships to the mission requirements of the proposed system. The bottom up analysis focuses to the human tasks which are associated with equipment choices. These approaches are in a boundary defined by the functional requirements analysis.

The identification of operator tasks are divided into collective tasks and individual tasks. Generally, doctrine prescribes the collective tasks to place a system or equipment into action. The Army Training and Evaluation Plan is the document used for the identification of mission events for the Predecessor system and is the starting point of like comparison of the collective tasks for the proposed system(s). The collective tasks organization includes the individual tasks. The individual tasks can be developed by

# RELIABILITY

DEMAND IS BASED ON:

- DEPENDENCY (METRIC) – SYSTEM'S USAGE
  - HOURS OPERATED
  - ROUNDS FIRED
  - MILES TRAVELED
  - OTHER (TAKE-OFF/LANDINGS)
- FREQUENCY – OCCURRENCE OF DEMAND
  - MAINTENANCE ACTIONS
  - MEAN (TIME/METRIC) BETWEEN MAINTENANCE ACTIONS
- CAUSE – FOCUS TO WHAT HAPPENED
  - HARDWARE
  - NON-HARDWARE
- EFFECTS – STATUS OF HARDWARE
  - INOPERABLE
  - PARTIALLY OPERABLE
  - NON-OPERABLE
  - OPERABLE

# MAINTAINABILITY

**RESOURCES CONSUMED BY THESE FACTORS:**

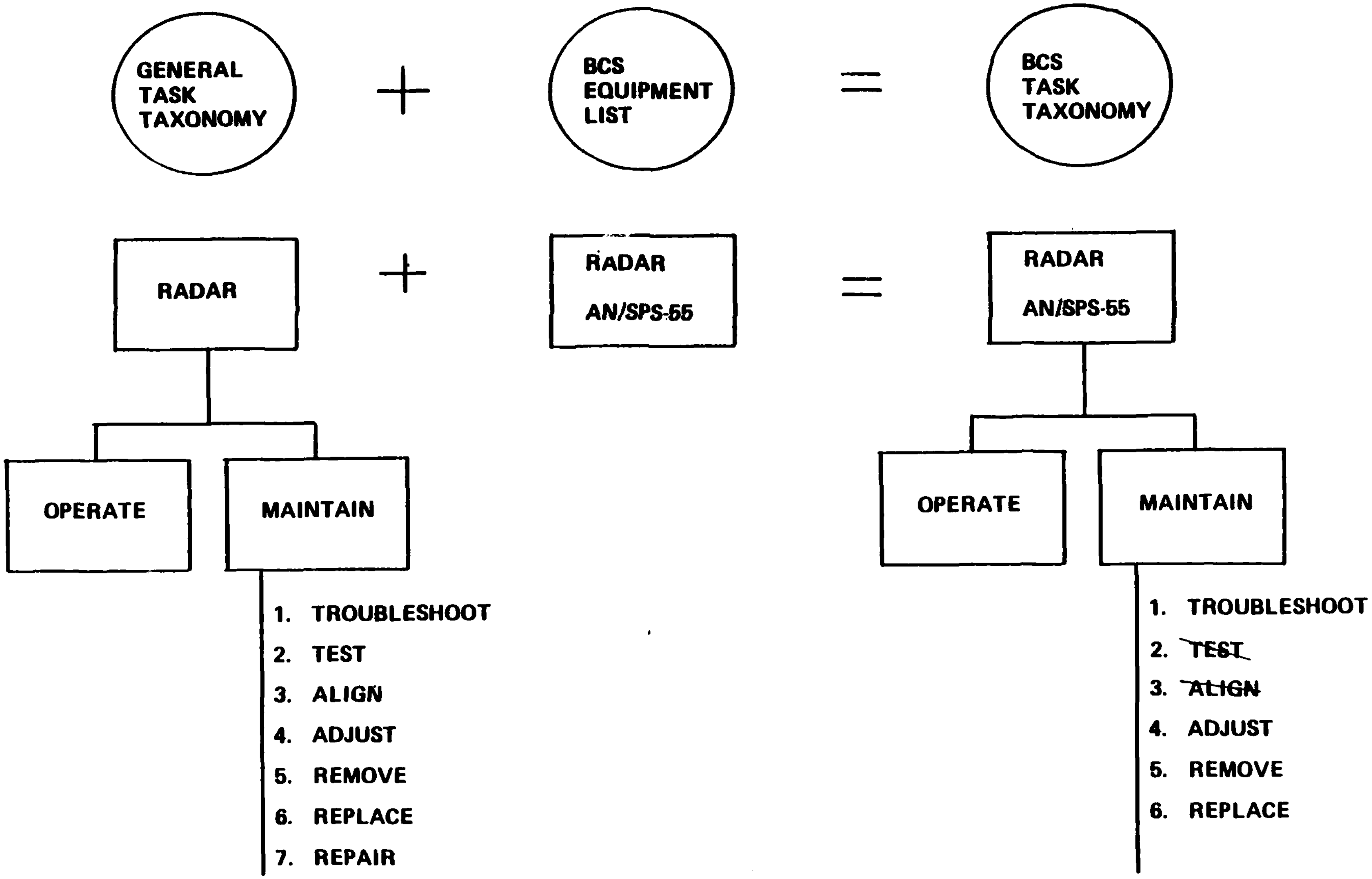
- MAINTENANCE ALLOCATION CHART REQUIREMENTS
- MEAN TIME TO REPAIR (MTTR)
- MAINTENANCE MANHOURS PER TASK
- MAINTENANCE RATIO

use of task data for the proposed system(s) and compared to the baseline comparison system task list which is developed in parallel with the equipment lists.

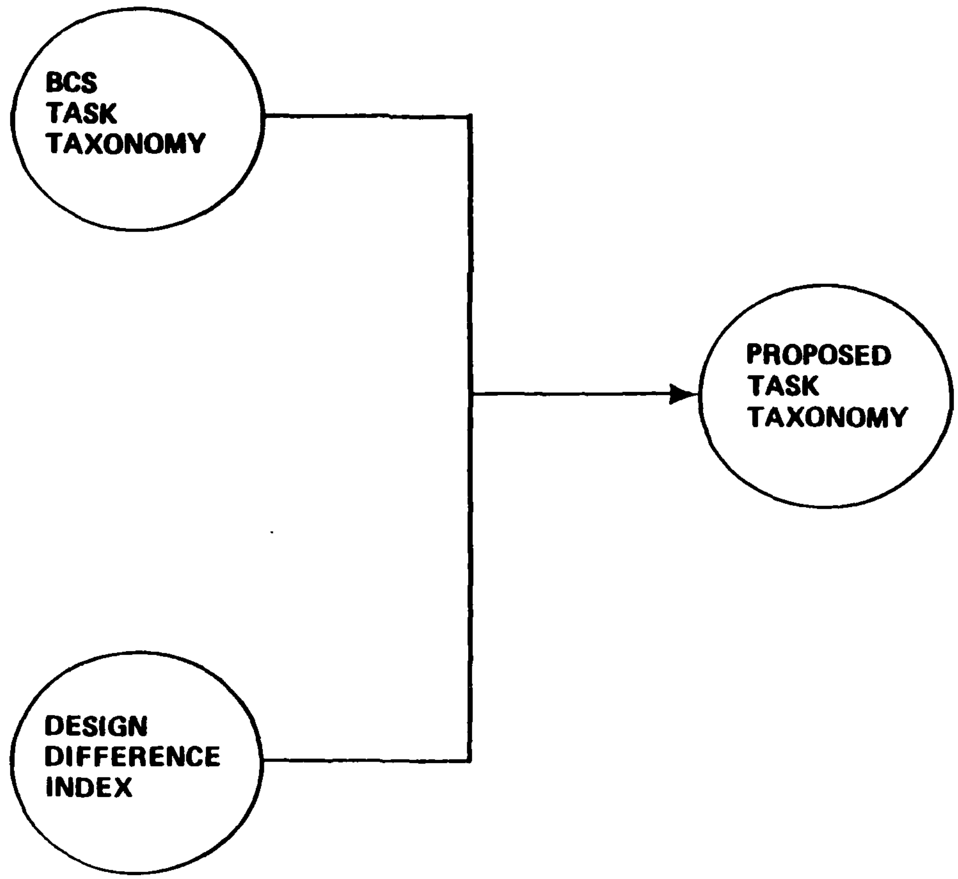
Another approach would be to develop the BCS system tasks and with them as the basis for the DDI then develop the projected system tasks. Then the functional requirements and equipment in the equipment comparability analysis are used to develop a representative tasks list for the proposed system. The resulting maintenance tasks are fully classified by the level of indenture, equipment breakdown structure and understanding of specifics of action verbs used to define maintenance actions (e.g., inspect, test, replace, repair, etc.). The equipment's reliability and maintainability also influences the identification of the individual maintenance tasks. This procedure is shown in Figures II-23 and II-24.

C. MODULE 3 - MANPOWER ANALYSIS. Manpower Requirements Analysis (step 2) provides for the determination of the Military Occupational Speciality (MOS) and grade, workload analysis and manpower requirements determination. This step incorporates the MARC process and AR 570-2 to determine manpower requirements based upon historical information, the Enlisted Personnel Management System (EPMS), and workload analysis. The MOS/Grade Determination is based upon the selection of the candidate MOS predicated upon the equipment list and task lists from step 1. The use of the predecessor system provides a starting point for the identification of probable MOS and grade (skill level) requirements. It is obvious that this process must be compatible with the EPMS. It also must be compatible with the Army Training System to gain full

# DETERMINE BCS TASKS



# DETERMINE PROPOSED SYSTEM TASKS



benefits to the U.S. Army. To select the candidate MOS first high comparability is sought between the tasks and the MOS as shown in Figure II-25. If high comparability, based upon tasks, equipment, test equipment, knowledges and skills can't be achieved then high equivalency must be sought. High equivalency is based upon tasks, like equipment, like test equipment, and general knowledges within an MOS. If high equivalency can't be achieved then rough equivalency must be established to a career management field to make the MOS selected fit. No equivalency can require the establishment of a new MOS because little or no comparability within the U.S. Army EPMS structure exists. The skill level assignments are some times "duty position based" after the MOS is selected the skill level requirements are addressed using the task, equipment, test equipment, knowledges and skills criteria as shown in Figure II-26. If this routine isn't satisfactory a routine for stratification of skill levels for the operator and maintainer is instituted based upon AR 611-201 Standard of Grades as shown in Figure II-27. The pay grade to skill level relationship groups grades E1 through E4 under skill level 1 which is considered the apprentice level for E1 to E3 and the primary level for the E4. Skill level 2 matches pay grade E5, skill level 3 matches pay grade E6, skill level 4 matches pay grade E7, and finally skill level 5 includes pay grades E8-E9. The training levels are basic trainee (E1), soldier apprentice/AIT trainee (E2), soldier apprentice (E3), journey person (E4), primary level (E5), basic level (E6), advanced level (E7), and senior level (E8/E9).

Each of these classifications of MOS and grade level provides parameters for the selection of the appropriate

# INITIAL MOS/GRADE DETERMINATION (PHASE I)

- DETERMINE OPERATIONAL/MAINTENANCE CONCEPTS
- IDENTIFY SYSTEM'S FUNCTIONAL BRANCH AREA
- IDENTIFY CURRENT MOS ASSIGNED TO FIELDED EQUIPMENT/SUBSYSTEMS (PREDECESSOR/BCS)
- IDENTIFY CURRENT MOS FOR SIMILAR EQUIPMENT TECHNOLOGIES/CATEGORIES FOUND ON PROPOSED SYSTEM
- COMPARE GENERIC TASK REQUIREMENTS TO CURRENT MOS TASK DESCRIPTIONS
- IDENTIFY EXISTING MOS/GRADES IN EXISTING TOE
- IDENTIFY RANGE OF PAYGRADES FOR EXISTING MOS

# REFINE MOS/GRADE DETERMINATION (PHASE II)

- CONSTRUCT OPERATOR AND MAINTAINER SCENARIOS
- DETERMINE DUTY POSITIONS AND ASSOCIATED SKILL LEVELS
- CALCULATE *WORKLOAD* REQUIREMENTS
- IDENTIFY EXISTING TRAINING TASKS AND COURSES
- REVISE DECISIONS AS REQUIRED

# FINAL MOS/GRADE DETERMINATION
# (PHASE III)

- DETERMINE TRAINING TASKS FOR PROPOSED SYSTEM
- DETERMINE STANDARDS OF GRADE AUTHORIZATION
- REVISE DECISIONS AS REQUIRED

## IMPACT ANALYSIS

- ANALYZE TRAINING RESOURCE REQUIREMENTS

  COURSE LENGTHS
  COURSE COSTS
  NUMBERS OF INSTRUCTOR

- ANALYZE PERSONNEL SUPPORTABILITY
- ITERATE THE METHODOLOGY

MOS/Grade based upon the task identification routine. The workload analysis is conducted differently for the operators and maintainers. The task identification routines, equipment, comparability analysis, MOS/Grade determination and functional requirements analysis are provided to the workload analysis. The workload analysis for the operator is conducted within the system/equipment mission and functional parameters for each MOS and skill level. The workload analysis for the maintainer is conducted within the maintenance level parameters, each maintenance MOS is associated with each maintenance level, and skill level. The operator's workload generally proceeds from the end items, to duty positions, to skill level, and to the MOS based upon the following logic. The determination is based upon the minimum operators required by each discrete function. It follows the sequencing of functions required by doctrine or new concepts or a presented in the O&O plan. It recognizes the conditions of linear, non-linear, series, and parallel functions.

The largest simultaneous requirement determines the minimum crew size (each duty position) for one repetition of a sequence. It recognizes the need to repeat sequences to satisfy scenario requirements. It aggregates the workload as the appropriate classification. It loads minimum position requirements up to individual capacity. Finally, the logic adds additional position until all workload is assigned. The operator workload analysis is highly specific to the system under analysis. It acknowledges that some workload is not geared to modelling. It provides for the minimum workload analysis to arrive at the estimates.

The maintainers workload analysis is aggregated by end item and maintenance level. The computations for equipment man-hours is performed. This data is grouped by category to the appropriate maintenance level, equipment, MOSs, skill level(s) and duty position(s). The density of equipment requires aggregation by the number of systems to provide the final estimates. The maintenance workload logic is based upon the general theory that intensity times reliability times maintainability equals the workload. The outputs of the routine are provided to the manpower requirements determination. The manpower requirements determination is generally a fixed drill. It determines requirements based solely on the MARC process and data contained in AR 570-2. It can and does determine requirements based on historical information. This activity can also determine requirements using a modified MARC when such actions are justified. The basic equation is the workload plus force structure divided by capacity equal the manpower requirements as shown in Figure II-28. These requirements are arrayed by MOS for ease of reference for other inputs to other analyses. This includes the manpower analysis (step 2) of HARDMAN.

D. MODULE 4 - TRAINING ANALYSIS. The Training Resource Requirements Analysis (TRRA) (Step 3) includes the tasks comparability analysis course requirements analysis, and training cost and resource determination. The objectives of the TRRA are to: (1) provide decision makers with estimates of training resource requirements and costs for institutional training; (2) provide resource planners with early estimates of the resource requirements and costs of training products, devices, media facilities, and courses; (3) provide program and training managers with input to new weapon system training documents and

# MANPOWER REQUIREMENTS DETERMINATION
# (STEP 2C)

**GENERAL:**

$$\frac{\text{WORKLOAD X FORCE STRUCTURE}}{\text{CAPACITY}} = \text{MANPOWER}$$

**SPECIFIC:**

$$\frac{\boxed{\begin{array}{c}\text{WORKLOAD}\\ \hline \text{TOTAL MANHOURS/ SYSTEM}\end{array}} \times \boxed{\begin{array}{c}\text{FORCE STRUCTURE}\\ \hline \text{SYSTEM DENSITY}\end{array}}}{\boxed{\begin{array}{c}\text{CAPACITY}\\ \hline \text{AVAILABLE MANHOURS/ POSITION}\end{array}}} = \text{POSITION REQUIRED}$$

processes such as the Individual Collective Training Plan (ICTP), the Qualitative and Quantitative Personnel Requirements Information (QQPRI) and the Cost and Training Effectiveness Analysis (CTEA); (4) provide training developers with a list of suitable existing training and estimates of modified/new tasks, media and programs of instruction so that this data can support the design and development of the new systems program(s); and (5) provide personnel and force structure analysts with task/skill data and student characteristics for assessing job difficulty and aptitude requirements.

There is significant interaction between this step of HARDMAN and the System Analysis (step 1), Manpower Requirements Analysis (step 2), and the Personnel Requirements Analysis (step 4). The TRRA can be applied at two levels general for early phases of the LCSM Model, and more detailed for later phases of the LCSM Model. It must be stated that all estimates in the TRRA are based on the best available data. The focus of TRRA is the generation of estimates for training products. Only resident instruction for individual training courses are covered. The "steady state" year is used. The steady state year is defined as the first year in which the Army Training System is producing only replacement training to support the new system, which is fully deployed. Training associated with the proposed system's operational test and evaluation, transition and initial materiel fielding is not estimated. The development and acquisition costs of training devices, equipment, media and other training products are not estimated. It is assumed in TRRA that existing courses, in total or part, are satisfying the quality standards. The detailed estimates provided by HARDMAN include training

resources and costs for operators and maintainers assigned to the subsystem and those non-commissioned officers, warrant officers, and commissioned officers directly responsible for their supervision. The level of supervision and technical capability incorporated into the HARDMAN application extends to skill level 3. Training routines for the other levels, warrant officers and commissioned officers can be performed but are not normally a part of the HARDMAN application unless specially represented. Collective training requirements are not considered in HARDMAN.

Task Comparability in the TRRA uses the precepts shown in Figure II-29. Conducting the TRRA involves three basic phases. During the first phase, the training data required to support the Predecessor System are obtained and formatted. During the second phase, a Baseline Comparison System (BCS) training program is established. This program is consistent with the BCS equipment and manning requirements developed in HARDMAN Steps 1 and 2, respectively. Since the BCS is composed of existing subsystems, the BCS training program is essentially a compilation of elements from those subsystems' course and task requirements. Exceptions to this occur under two conditions: (1) a BCS equipment is so new that its courses and tasks have not yet been fully developed, or (2) a BCS equipment is selected from outside the Army inventory (e.g., a Navy aircraft engine). Since the selected BCS equipment lack Army training documentation, a further analytical step must be taken.

A comparability analysis is applied to identify existing Army equipment which most closely resemble the BCS equipment. These comparable tasks and courses are then

# TRAINING COMPARABILITY ANALYSIS

DEFINE EXISTING TRAINING PROGRAM → IDENTIFY IMPACTS OF DESIGN DIFFERENCES → DEFINE BCS TRAINING PROGRAM → DEFINE PROPOSED SYSTEM TRAINING PROGRAM

**DEFINE EXISTING TRAINING PROGRAM**

- AR 611-201
- SOLDIERS/ COMMANDERS MANUALS
- TRAINER'S GUIDES
- PROGRAMS OF INSTRUCTION (POI)
- ATRM--159 TRAINING COST DATA

**IDENTIFY IMPACTS OF DESIGN DIFFERENCES**

- Δ TASKS
- Δ COURSES
- Δ RESOURCES
- Δ COSTS

**DEFINE BCS TRAINING PROGRAM**

- REFLECTS DESIGN DIFFERENCES BE-TWEEN BCS AND EXISTING SYSTEM
- QUASI – POI
  - TASKS
  - COURSES
  - RESOURCES
  - COSTS

**DEFINE PROPOSED SYSTEM TRAINING PROGRAM**

- REFLECTS DESIGN DIFFERENCES BE- PROPOSED SYSTEM AND BCS
- QUASI – POI
  - TASKS
  - COURSES
  - RESOURCES
  - COSTS

modified to reflect differences between the selected BCS equipment and comparable existing equipment. During the third phase, the Proposed System's training program is established. BCS course and task data are modified, where necessary, or other existing course and task data are obtained to reflect differences between Proposed System and BCS equipments. If the Proposed System has documentation on a planned training program, the modifications made in this procedure are intended to reflect this plan. Otherwise, using the best available data and descriptions of the Proposed System, BCS courses and tasks are modified to reflect the impacts of design differences. Embedded in these phases are functions to delineate the task characteristics and final assignment of the task to a specific MOSC and skill level.

Task Comparability Analysis, Course Requirements Analysis, and Training Cost and Resources Determination comprise the three substep groups of the TRRA. These substep groups represent distinct components of a training system and are easily identified within the Army training system. Each group requires a different set of training data for input, uses different analytical procedures, and results in the development of distinct products.

The main difference between general and detailed TRRA applications concerns inclusion of these substep groups. In a general TRRA, only Course Requirements Analysis and Training Cost and Resources Determination are included. However, in a detailed TRRA, a Task Comparability Analysis is also conducted.

In the Course Requirements Analysis all existing or comparable courses are identified for courses of instruction required for each system configuration. Comparable courses are found for those courses that are totally new, taught in a non-Army school, or have been recently created from a previous course as shown in Figure II-30. Resource parameters of these comparable courses - type of course, optimum class sizes, attrition rates, and detailed cost data - are used to estimate the resource requirements of the courses required for each system configuration. The objective of this step is to compare courses that do not have a TRADOC course-cost report with existing courses that do have the necessary cost and supplementary resource information. The descriptions and characteristics of the course that lacks data are compared with those of existing courses to find the closest match. Input from earlier HARDMAN activities include (1) the quasi-programs of instruction and (2) the number of system-specific graduates to be trained. Additional input to this activity include: (1) detailed course cost data, which is produced annually by TRADOC Headquarters under Reports Control Symbol ATRM-159, and (2) descriptions of all course of instruction presently being conducted in TRADOC training centers and formal school. This analysis results in a list of all system-specific courses and, where necessary, a comparable course that is used to estimate cost and other resources. The comparable course cost and resource estimates form input for all subsequent substeps except training device identification.

The TRADOC course-cost program analyzes and reports on the courses of instruction conducted in TRADOC formal schools and training centers. Reports produced by this program cover one fiscal year. Three instances require identification of comparable courses. First, at any given time, the

# IDENTIFY EXISTING COURSES OF INSTRUCTION

- DA PAM 351-4 (U.S. ARMY FORMAL SCHOOLS CATALOG)
- DA PAM 351-9 (EPMS MASTER TRAINING PLAN)
- MOS TRAINING COST HANDBOOK (MOSB)
- INTERSERVICE TRAINING REVIEW ORGANIZATION
- U.S. AIR FORCE
- U.S. NAVY
- U.S. MARINE CORPS
- U.S. COAST GUARD
- INDUSTRY

latest reports available from this program cover Army courses conducted from one to two and a half years earlier. Over this period, new courses may have been added, while others may have been disbanded. Information will not be available on Army courses added since the issuance of the last course-cost reports. Consequently, the analyst must identify a comparable course that does have a course-cost report. In this manner, data for the existing comparable course can be sued to estimate costs and other resource parameters for the new course.

Second, the design impacts of a new materiel system may require creation of new courses. As with the first instance, a comparable course would need to be identified in order to estimate costs and other resource elements. Finally, for some Military Occupational Specialty (MOS) skill levels, attendance at a non-Army course may be required. Data for these courses are not readily available to the Army training analyst. When available, the data typically lack sufficient detail.

Training Costs and Resource Requirements determination serves as a primary tool for comparing system configurations. This analysis also serves as a means for determining the system's impact on scarce and cost-intensive Army training resources. Many different parameters can be measured to depict the resources required for training. Selection of the resource parameters considers three elements: (1) training data available for analysis, (2) the nature and scope of the training impacts to be studied, and (3) the level of meaningful training resource estimation needed to make decisions at each milestone in the materiel systems acquisition process. In this phase, estimates of the training resources needed to produce the "steady-state" replacement personnel are calculated. Training resources

are assessed only for system-specific courses. The term "system-specific course" refers to (1) the Advanced Individual Training (AIT) and additional skill identifiers (ASI) courses for all MOSs assigned to equipment in the Predecessor, Baseline Comparison, and Proposed Systems and (2) the Noncommissioned Officer Education System (NCOES), warrant and commissioned officer courses providing direct instruction on system-specific equipments. NCOES courses that concentrate on leadership or supervisory skills are not included (e.g., the Primary Leadership Development Course). During the first HARDMAN application to a particular system, these four parameters are usually chosen to depict the Training Resource Requirements: (1) Training Man-Days - the length of time needed to train students in a course; (2) Instructors - the number of trainers needed to conduct Courses of Instruction (COI); (3) Course Costs - the amount of money required to train graduates of COIs; and (4) Other Training Resources - a list of candidate training devices used in training. As the system is further defined, subsequent applications or iterations of the analysis permit more detailed examinations of these and other training resource requirements.

Regarding the identification of new system training devices, HARDMAN can provide the information necessary for the identification of new, major training devices. Using the individual and collective task information produced as part of a general TRRA, this data can yield the initial recommendation as shown in Figure II-31.

E. MODULE 5 - PERSONNEL ANALYSIS. The Personnel Requirements Analysis (step 4) has as an objective to estimate the personnel requirements for a new system. It is a single analysis routine. Personnel requirements represent the direct manpower (spaces) required by the hardware system

# IDENTIFICATION OF CANDIDATE TRAINING DEVICES

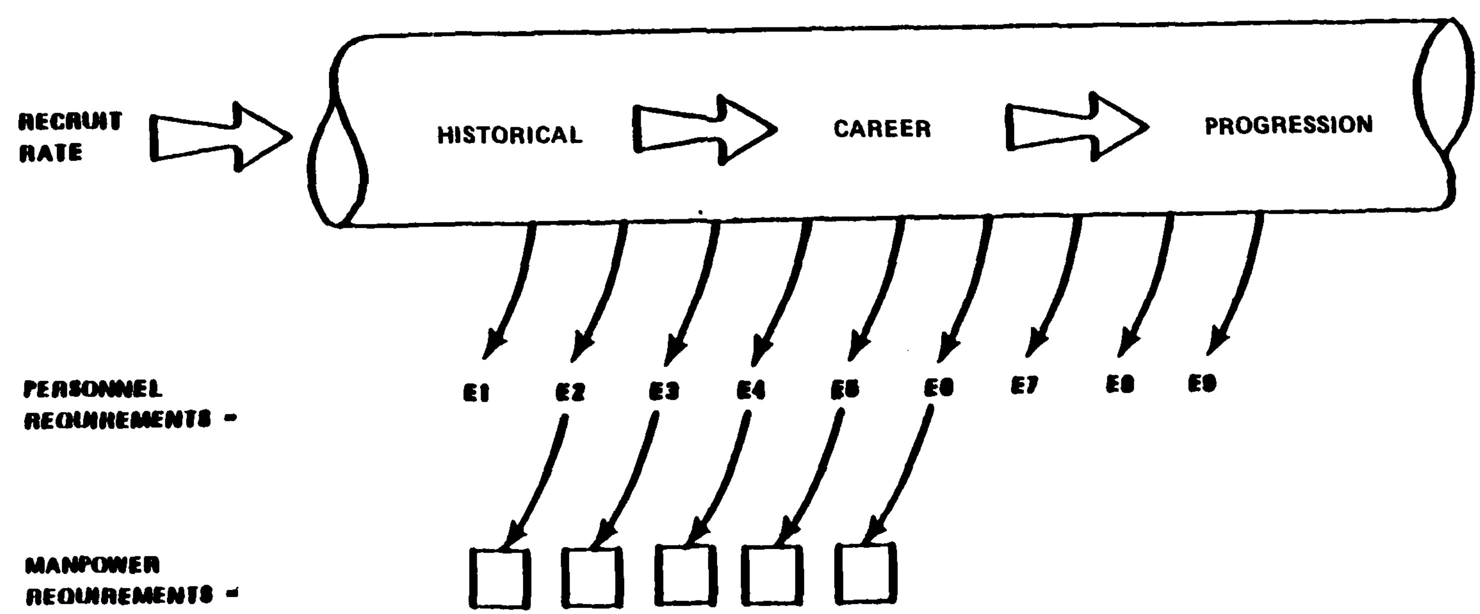
- USES COMPARABILITY ANALYSIS
- SYSTEM CRITERIA
  - INDIVIDUAL TASK SUPPORTED
  - COLLECTIVE TASK SUPPORTED
  - BOTH
- TYPES OF DEVICE
  - NON-SYSTEM
  - SYSTEM
- USE OF DEVICE
  - WHOLE TASK
  - PART TASK

plus additional spaces to keep the manpower spaces filled over time as shown in Figure II-32. The analysis uses the promotion and attrition rates for the Defense Manpower Documentation Center and the TTHS rates from MILPERCEN to determine personnel requirements by MOS AND grade. These computations are calculated on a steady state, annual basis. This steady state time period is after full materiel fielding requirements have been met. It projects the flow rates starting with the annual recruit intake requirements for each specific MOS. The result is a comparative personnel structure for each applicable MOS paygrade and the annual intake to each paygrade, including recruits. The structure indicates the figures for each impact on the personnel requirements based upon historical, career and progressive patterns for each of the MOSs. This is a straight forward mathematical activity.

F. MODULE 6 - IMPACT ANALYSIS. The Impact Analysis has four objectives: (1) identify the demands ("high drivers") a proposed system would place on the present and future supply of manpower, personnel and training resources; (2) identify the source and analyze the parameters of the "high drivers"; (3) identify areas for a tradeoff analysis; and (4) identify and project future MPT demands in order to counteract potential shortfalls.

The need to quantify the demands a new system will make upon the manpower, personnel and training resource pool is the intent of the Impact analysis. The Impact analysis is focused on the supply versus demand nature of the various output. The need to identify shortfalls or high driver elements which Impact on resource requirements are achieved by asking can the supply satisfy the demand, and if not, what is the optimum solution? This required information points to the factors which will influence changes in

# PERSONNEL REQUIREMENTS ANALYSIS
# (STEP 4B)



demand. These changes will in turn be measured against the projected supply. The other routines of the tradeoff analysis address the training resource availability in the area of instructors and other significant resources for institutional training within the framework of the HARDMAN methodology. The determination of operator, maintainer, and repairer training resource costs are examples of critical training resource requirements addressed by the Impact Analysis. Key to this analysis is the personnel availability issues addressed earlier. The need to acquire personnel strength projections, and determine the availability of personnel for the applicable MOSs cannot be underplayed. Other issues that may be addressed are focused to the mix of civilian versus military manpower requirements of the system based upon the degree of technology represented by the system. With a new system, the old MOS might not work as configured so the requirements for new MOS(s) might be key here. The supportability issues of HARDMAN provide for informal system reviews and more importantly for accurate planning, programming and budgeting for system requirements based upon a comprehensive, coordinated, and cohesive effort.

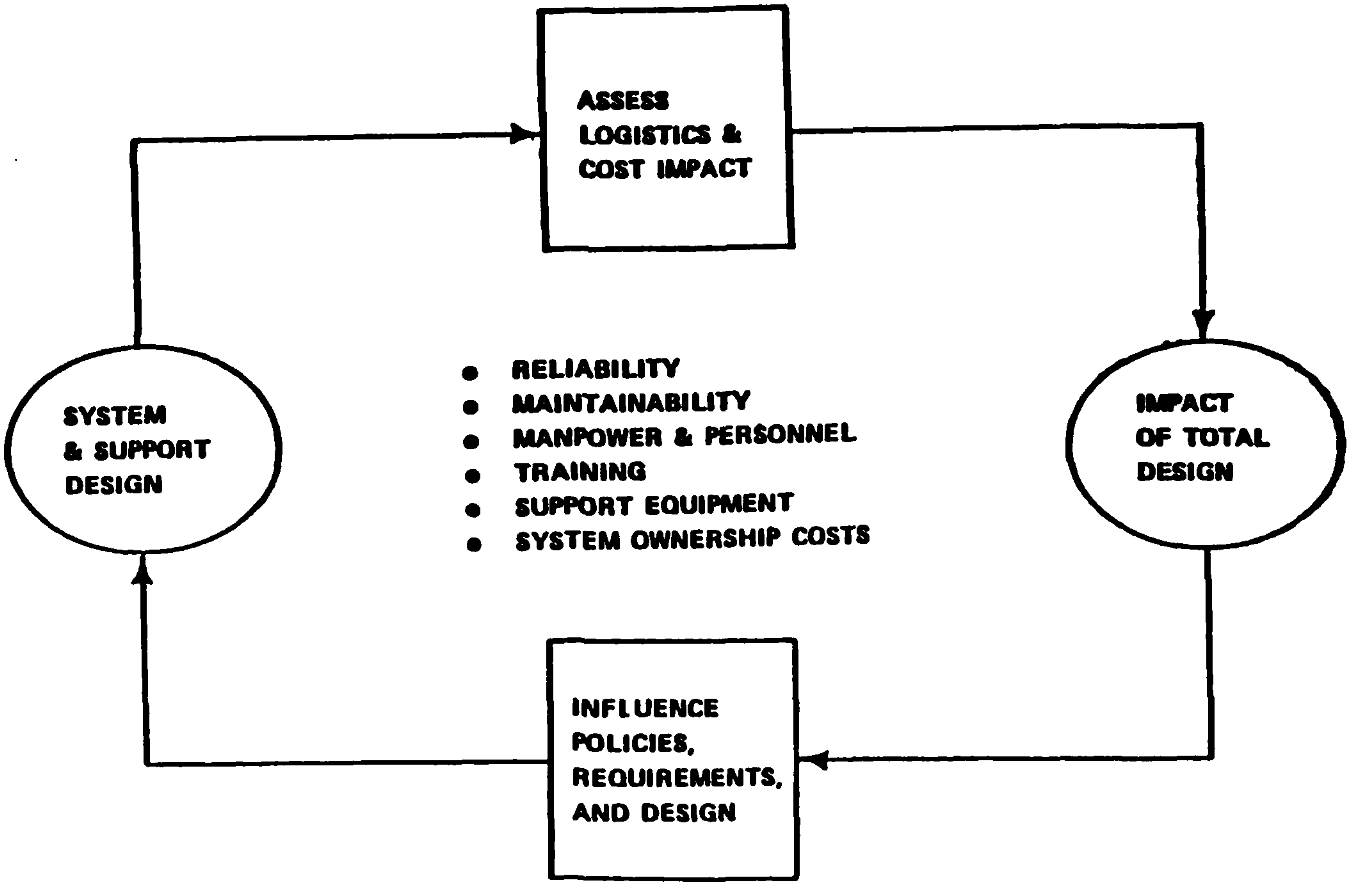
G. MODULE 7 - TRADEOFF ANALYSIS. The Tradeoff Analysis objectives focus to three areas. First, to identify the alternatives that reduce or alleviate manpower, personnel and training high drivers; next, to assess the impact of the alternatives on the manpower, personnel and training requirements; finally, to identify and assess the manpower, personnel and training impacts of additional system changes as they occur during the phases of system acquisition.

It is the tradeoff analysis which reflects the true essence of the HARDMAN methodology. The potential usefulness is

centered in the identification of possible problem areas with the HARDMAN application to step 5. Probable solutions to these problems can be analyzed by the tradeoff alternative. These alternatives can reduce or alleviate those support elements which demand a disproportionate share of the newly proposed system(s).

The tradeoff analysis can be performed in any area which impacts on the MPT issues, as shown in Figure II-33. The majority of these issues are surfaced in the Impact Analysis (step 5) for processing the Tradeoff Analysis (step 6). The approach is quite clear. The Tradeoff Analysis prioritizes the critical MPT factors identified in the Impact Analysis. A range of potential solutions of alternatives for each requirement is also determined and prioritized for Tradeoff Analysis. The HARDMAN Methodology may be repeated or iterated, to develop the most probable response to each variable (critical resource requirement). The data of the new finding of the Tradeoff Analysis is incorporated into the data base as a separate iteration for audit trail review purposes. In summary, the analysis provides for alternatives, analysis of priority alternatives which meet scientific, expert and judgmental merit. The analysis of the changes (MPT) which are selected for tradeoff analysis are run through the HARDMAN Methodology to provide an optimum solution among the alternatives analyzed for use by the decision makers in meeting materiel acquisition strategy goals and guidelines.

# TRADEOFF CAPABILITY
# (STEP 6)



IV. HARDMAN OUTPUT. The HARDMAN output will be addressed by the six steps of the methodology. The products generated by the HARDMAN methodology are shown in Figure II-34. Also presented in Figure II-35 are the key areas these products impact within the materiel acquisition process as it addresses manpower, personnel and training issues.

A. MODULE 1 - OVERVIEW. The establishment of the system-specific consolidated data base is a product of each HARDMAN application. The validity of the HARDMAN methodology is predicated on the internal and external validity of this data base. The development of a narrative description (scenario) of the system, what it is to do and how it is to do it based upon materiel acquisition documentation is generated by HARDMAN. It is a descriptive scenario of the proposed system's characteristics. The baseline comparison system is also constructed for use in determining the design difference index. Both of these documents are generally the focus of the first in-process review of a HARDMAN application. It is through these two documents that the framework of the HARDMAN methodology is generally constructed.

The quantified manpower requirements by MOS and skill level and the quantified sustainment requirements for personnel are both key products. The identification of personnel considerations that require close evaluation and future monitoring is also a product. The training analyses provide the institutional training picture load, changes or increases by MOS, the annual instructor requirements and projects annual training costs in conformance with TRADOC guidelines. The initial logistics support analysis data for manpower, personnel and institutional training costs and requirements are also addressed. Finally, the identification of areas for possible system development

# HARDMAN PRODUCTS

- QUANTIFIED MANPOWER REQUIREMENTS (BY MOS & SKILL LEVEL)
- QUANTIFIED SUSTAINMENT REQUIREMENTS – PERSONNEL
- PERSONNEL CONSIDERATIONS THAT REQUIRE CLOSE EVALUATION AND FUTURE MONITORING
- PROJECTED TRAINING INCREASES (BY MOS)
- ANNUAL INSTRUCTOR REQUIREMENTS
- PROJECTED ANNUAL TRAINING COSTS
- INITIAL LOGISTICS SUPPORT ANALYSIS DATA
- IDENTIFICATION OF AREAS FOR POSSIBLE SYSTEM DEVELOPMENT CHANGES TO INCREASE PERSONNEL SUPPORTABILITY
- SYSTEM SPECIFIC DATA BASE

# HOW HARDMAN PRODUCTS SHOULD BE USED

- SOURCE SELECTION AND EVALUATION
- HUMAN RESOURCE – EQUIPMENT DESIGN TRADEOFFS
- UPDATES AND REASSESSMENTS OF O&O PLAN
- INPUTS FOR TRAINING SUPPORT PLAN
- TENTATIVE QQPRI AND BOIP DEVELOPMENT
- INPUTS FOR COEA DEVELOPMENT
- INPUTS FOR ICTP AND IKP
- INPUTS FOR ASARCS

changes to increase personnel supportability are fully examined based upon the alternatives which support such analyses.

Clearly, the HARDMAN products will impact source selection and evaluation. It also ensures that manpower, personnel and institutional training resource requirements are addressed to influence equipment design. It provides for an update and reassessment of the O&O plan. The methodology supports the tentative QQPRI and BOIP development and can stand alone as the preliminary training effectiveness analysis for input to the PQA or COEA. As the HARDMAN applications are conducted, the lessons learned can contribute to the input for the ASARC boilerplate. All of these products and their impacts only add to the fidelity and worth of the data the action offices and decision makers use in the materiel acquisition process. The remainder of this section will discuss the key output of the HARDMAN methodology by step and activity or sub-analysis.

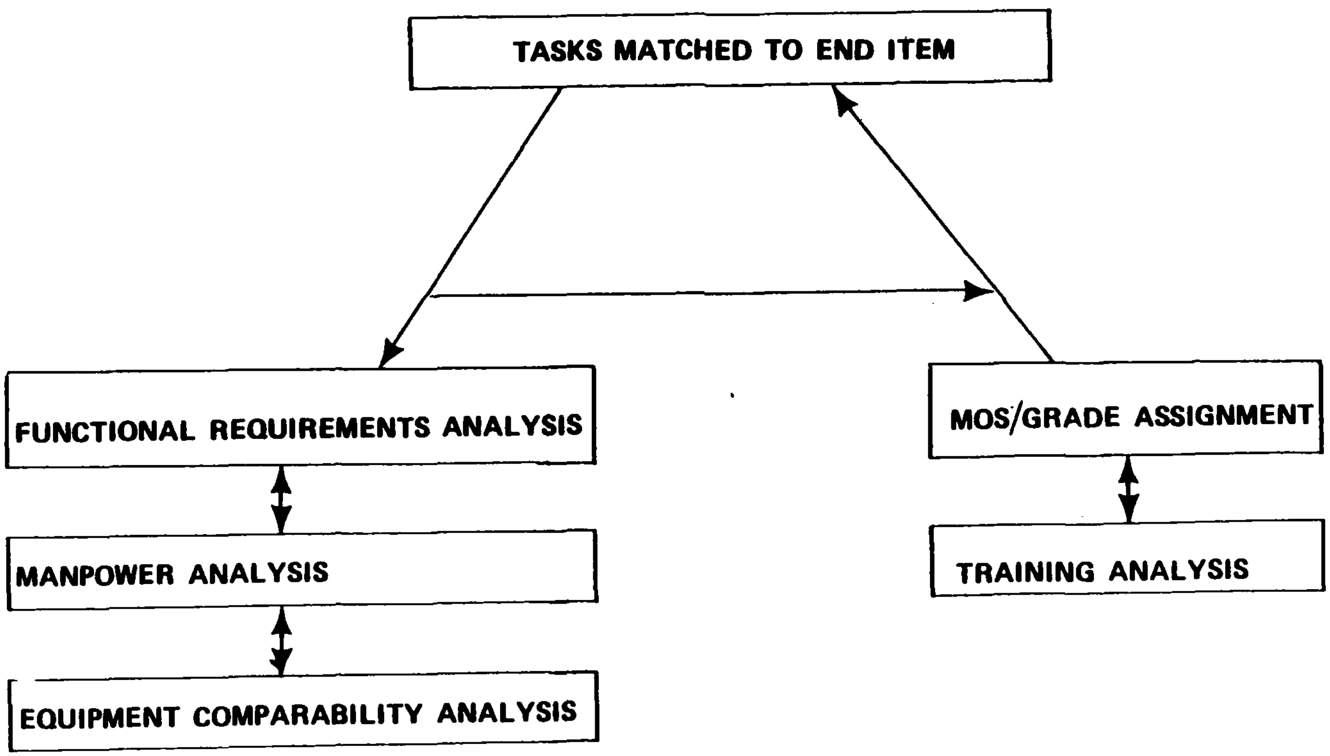
B. MODULE 2 - SYSTEMS ANALYSIS. The Systems Analysis (Step 1) provides for the identification of mission requirements both general and system specific. It also provides for the development of the scenario. The consolidated data base is begun prior to this step. The functional requirements analysis provides for the identification of the system functional requirements. The equipment comparability analysis provides for the construction of a baseline comparison system and the crossover in terms of mission, equipment and function(s) and task(s) of the predecessor system and the equipment list which supports the proposed system(s). The reliability and maintainability routines (R&M) provide for the workload analysis factors and the R/M parameters. During the task identification activity, the tasks are matched to the end

item. The initial draft of the design difference index is established at the end of the Systems Analysis step. These structures and output are used in succeeding analyses.

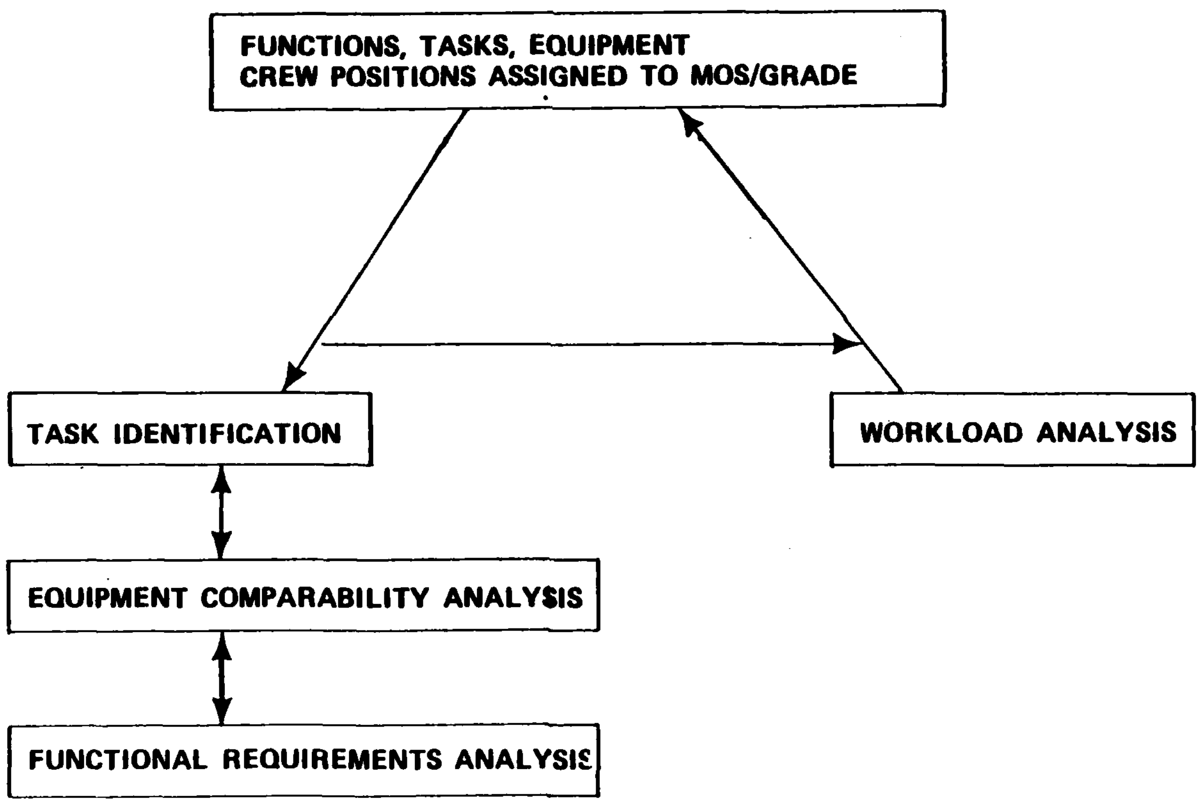
C. MODULE 3 - MANPOWER ANALYSIS. The Manpower Requirements Analysis (Step 2) based upon MOS/grade assignment, Workload Analysis and Manpower Requirements Determination provides for the assignment of functions, tasks, equipment and crew positions assigned to MOS/Grade. The interrelation of these three activities is shown in Figure II-36, 37 and 38. Also addressed at this time is the association of the tasks to course data requirements. The workload analysis focuses the operator's workload and maintainer's workload to a specific MOS. The manpower requirements determination provides specific manpower requirements by MOS, grade and skill level arrayed to display the manpower required by the predecessor, the BCS, and proposed alternative systems. This is done for a system. It is next done for the total system density. It is also presented by total requirements to include a force structure summary. The maintainer requirements are also provided by the various levels of maintenance, organizational, typically operator/crew, direct and general support. These are the output of the Manpower Requirements Analysis (Step 2). Examples of these products are shown in Figures II-39 through II-43.

D. MODULE 4 - TRAINING ANALYSIS. The Training Resource Requirements Analysis based on the task comparability using the equipment structure provided in the equipment comparability analysis as an input, the course requirements, and the training cost and resource determination analysis provide the following output. Task comparability provides for the final MOS and skill level determination, skill and knowledge requirements and the

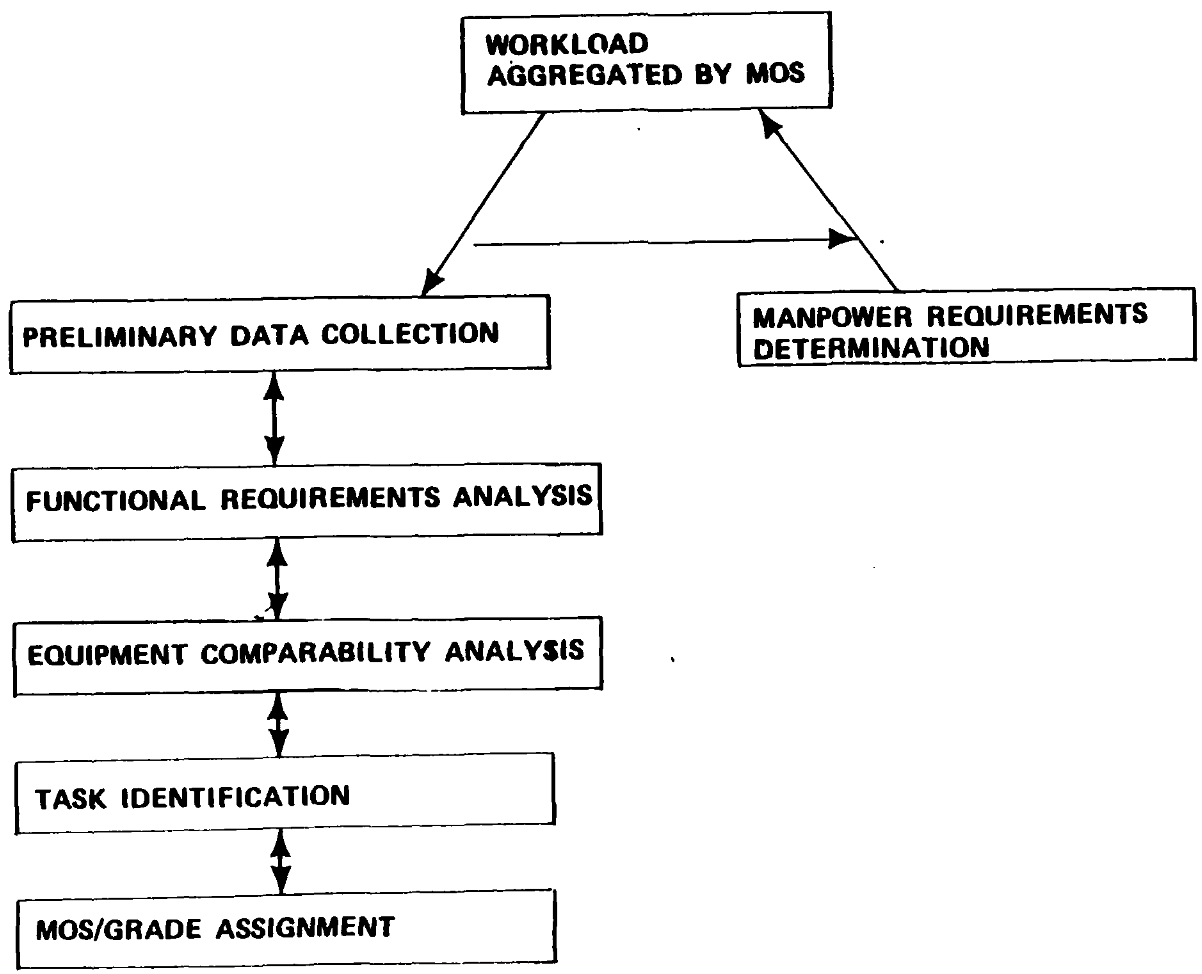
# TASK IDENTIFICATION



# MOS/GRADE ASSIGNMENT



# WORKLOAD ANALYSIS



# MANPOWER: OPERATOR/CREW REQUIREMENTS (SYSTEM DENSITY : 1)

| | | | PROPOSED SYSTEM ALTERNATIVES | | |
|---|---|---|---|---|---|
| MOS | PREDECESSOR* | BCS | ALT 1 | ALT 2 | ALT 3 |
| 13X | 14 | 8 | 7 | 10 | 4 |
| 19V | 10 | 8 | 5 | 4 | 6 |
| TOTAL | 24 | 16 | 12 | 14 | 10 |

* Per TOE

# MANPOWER UNIT MAINTENANCE REQUIREMENTS
# (SYSTEM DENSITY : 24)

| | | | PROPOSED SYSTEM ALTERNATIVES | | |
|---|---|---|---|---|---|
| MOS | PREDECESSOR * | BCS | ALT 1 | ALT 2 | ALT 3 |
| 31V | 0 | 8 | 0 | 2 | 8 |
| 35E | 0 | 16 | 0 | 1 | 1 |
| 45D | 6 | 13 | 16 | 14 | 5 |
| 63D | 6 | 2 | 2 | 4 | 3 |
| 63J | 0 | 1 | 0 | 1 | 1 |
| TOTAL | 12 | 40 | 18 | 22 | 18 |

* Per TOE

# MANPOWER: INTERMEDIATE MAINTENANCE (FORWARD) REQUIREMENTS

| MOS | PREDECESSOR * | BCS | ALT 1 | ALT 2 | ALT 3 |
|---|---|---|---|---|---|
| | | | PROPOSED SYSTEM ALTERNATIVES | | |
| 31E | 9 | 10 | 23 | 10 | 23 |
| 31S | 0 | 0 | 6 | 0 | 6 |
| 34Y | 6 | 0 | 1 | 1 | 1 |
| 35E | 9 | 0 | 27 | 1 | 1 |
| 35H | 0 | 0 | 1 | 0 | 1 |
| 41C | 6 | 5 | 1 | 1 | 1 |
| 44B | 0 | 1 | 1 | 1 | 1 |
| 45B | 3 | 0 | 2 | 2 | 2 |
| 45L | 15 | 65 | 65 | 65 | 10 |
| 63G | 9 | 1 | 1 | 1 | 1 |
| 63H | 42 | 1 | 1 | 8 | 5 |
| 63J | 3 | 0 | 3 | 1 | 3 |
| TOTAL | 102 | 83 | 132 | 91 | 55 |

* Per TOE
Values include support for other LINs

# MANPOWER: FORCE STRUCTURE SUMMARY

| | | | | Proposed System Alternatives | | |
|---|---|---|---|---|---|---|
| LEVEL | BASIS | PREDECESSOR | BCS | ALT 1 | ALT 2 | ALT 3 |
| Company | 8 Crews | 72 | 56 | 120 | 96 | 56 |
| Battalion | 24 Crews | 216 | 168 | 360 | 288 | 168 |
| | 1 Unit Maintenance | 12 | 40 | 18 | 22 | 18 |
| | TOTAL BATTALION | 228 | 208 | 378 | 310 | 186 |
| Division | 72 Crews | 648 | 504 | 1080 | 864 | 504 |
| | 3 Unit Maintenance | 36 | 120 | 54 | 66 | 54 |
| | 1 IMA - Forward | 102 | 132 | 83 | 91 | 55 |
| | TOTAL DIVISION | 786 | 756 | 1217 | 1021 | 613 |

# MANPOWER: TOTAL REQUIREMENT
# (SYSTEM DENSITY : 848)

| MOS | PREDECESSOR | BCS | ALT 1 | ALT 2 | ALT 3 |
|---|---|---|---|---|---|
| | | | Proposed System Alternatives | | |
| 13B | 8,820 | 5,936 | 12,720 | 10,176 | 5,936 |
| 31E | 2 | 456 | 120 | 120 | 456 |
| 31S | 0 | 72 | 0 | 0 | 72 |
| 31V | 0 | 282 | 0 | 0 | 282 |
| 32G | 0 | 96 | 0 | 70 | 96 |
| 34Y | 0 | 24 | 0 | 24 | 24 |
| 35C | 0 | 192 | 0 | 12 | 12 |
| 35E | 0 | 324 | 0 | 12 | 12 |
| 35H | 0 | 12 | 0 | 0 | 12 |
| 41C | 15 | 120 | 432 | 36 | 36t |
| 44B | 0 | 24 | 24 | 24 | 24 |
| 45B | 7 | 24 | 0 | 24 | 24 |
| 45D | 343 | 459 | 565 | 494 | 176 |
| 45L | 244 | 1,548 | 1,548 | 1,548 | 216 |
| 63D | 518 | 70 | 70 | 141 | 105 |
| 63G | 0 | 24 | 24 | 24 | 24 |
| 63H | 357 | 72 | 72 | 165 | 120 |
| 63J | 0 | 71 | 0 | 47 | 71 |
| TOTAL | 10,306 | 9,806 | 15,575 | 12,917 | 7,698 |

assignment of tasks to MOS and skill level. The course requirements analysis provides for modified or additional course(s) of instruction by annex or program of instruction. It also provides for a candidate list of training devices. The output of the training cost and resource determination activity are arrayed by separate output, the annual man-day requirements output, the annual Instructor Requirement output and the Annual Cost for training. These output are the results of the TRRA. Example of these training step products are shown in Figures II-44 through II-46.

E. MODULE 4 - PERSONNEL ANALYSIS. The Personnel Requirements Analysis provides the annual recruits required for the proposed system(s) based upon the "steady state" training load after the completion of the materiel fielding plan and achievement of initial operational capability for the system or equipment(s) as shown in Figure II-47. It also provides for the personnel structure by total requirements (MOS) and by MOS and pay grade and the required number of recruits (annual) to support this structure. These are the key outputs of this analysis. Examples are shown in Figures II-48 through II-50.

F. MODULE 6 - IMPACT ANALYSIS. The Impact Analysis (Step 5) provides for a wide range of impact analyses based upon the critical or "high drivers" issues of the HARDMAN application to this point. The actual impacts are related to the significant manpower, personnel analysis training resource issues that are surfaced during the study. One such issue could be the impact of the ranked total manpower requirement and the associated manpower availability ratio, which address the supply and demand questions raised by the HARDMAN application. Similar issues could occur in equipment configuration and training issues.

# TRAINING: ANNUAL MAN-DAY REQUIREMENTS

## (IN THOUSANDS OF MAN-DAYS)

| | | | Proposed System Alternatives | | |
|---|---|---|---|---|---|
| MOS | PREDECESSOR | BCS | ALT 1 | ALT 2 | ALT 3 |
| 13B | 600.0 | 501.7 | 781.7 | 822.3 | 501.7 |
| 31E | 75.0 | 81.2 | 24.2 | 24.2 | 87.2 |
| 31S | N/A | 10.1 | N/A | N/A | 9.8 |
| 31V | N/A | 27.9 | N/A | 7.1 | 26.2 |
| 32G | N/A | 20.2 | N/A | N/A | 19.8 |
| 34Y | N/A | 5.2 | N/A | 4.9 | 5.2 |
| 35C | N/A | 8.4 | N/A | 1.3 | 1.3 |
| 35E | N/A | 52.9 | N/A | 4.5 | 6.2 |
| 35H | N/A | 3.5 | N/A | N/A | 3.5 |
| 41C | 3.2 | 14.2 | 36.8 | 5.7 | 5.7 |
| 44B | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 |
| 45B | N/A | 1.4 | N/A | 1.4 | 1.4 |
| 45D | 15.0 | 20.8 | 9.7 | 9.7 | 13.3 |
| 45L | 60.0 | 74.8 | 57.2 | 63.1 | 8.9 |
| 63D | 2.2 | 2.2 | 2.2 | 4.5 | 4.5 |
| 63G | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| 63H | 2.9 | 2.9 | 2.9 | 5.7 | 5.7 |
| 63J | N/A | 3.9 | N/A | 3.9 | 3.9 |
| TOTAL | 764.6 | 837.6 | 921 | 964.6 | 710.6 |

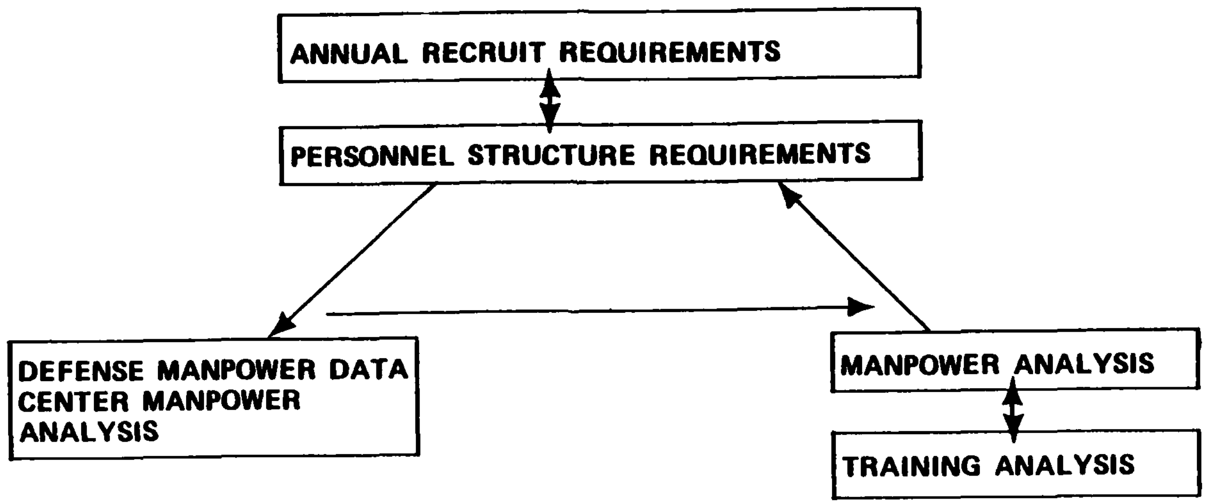
# TRAINING: ANNUAL INSTRUCTOR REQUIREMENT

| MOS | PREDECESSOR | BCS | Proposed System Alternatives: ALT 1 | ALT 2 | ALT 3 |
|---|---|---|---|---|---|
| 13B | 350 | 244 | 374 | 400 | 244 |
| 31E | 75 | 85 | 28 | 28 | 92 |
| 31S | N/A | 13 | N/A | N/A | 13 |
| 31V | N/A | 30 | N/A | 8 | 28 |
| 32G | N/A | 21 | N/A | N/A | 20 |
| 34Y | N/A | 2 | N/A | 2 | 2 |
| 35C | N/A | 14 | N/A | 2 | 2 |
| 35E | N/A | 54 | N/A | 5 | 7 |
| 35H | N/A | 2 | N/A | N/A | 2 |
| 41C | 10 | 15 | 38 | 6 | 6 |
| 44B | 5 | 5 | 5 | 5 | 5 |
| 45B | N/A | 2 | N/A | 2 | 2 |
| 45D | 17 | 35 | 16 | 14 | 23 |
| 45L | 96 | 104 | 91 | 101 | 17 |
| 63D | 1 | 1 | 1 | 3 | 3 |
| 63G | 2 | 2 | 2 | 2 | 2 |
| 63H | 3 | 3 | 3 | 6 | 5 |
| 63J | N/A | 3 | N/A | 3 | 3 |
| TOTAL | 559 | 635 | 558 | 587 | 476 |

# TRAINING: ANNUAL COSTS
# (IN THOUSANDS OF DOLLARS)

| MOS | PREDECESSOR | BCS | Proposed System Alternatives | | |
|---|---|---|---|---|---|
| | | | ALT 1 | ALT 2 | ALT 3 |
| 13B | 97,500 | 68,750 | 101,015 | 104,535 | 68,750 |
| 31E | 3,000 | 13,844 | 4,672 | 4,672 | 14,785 |
| 31S | N/A | 1,491 | N/A | N/A | 1,458 |
| 31V | N/A | 3,914 | N/A | 1,039 | 3;735 |
| 32G | N/A | 2,769 | N/A | N/A | 2,721 |
| 34Y | N/A | 1,005 | N/A | 974 | 1,005 |
| 35C | N/A | 2,570 | N/A | 583 | 583 |
| 35E | N/A | 10,018 | N/A | 1,096 | 1,462 |
| 35H | N/A | 442 | N/A | N/A | 442 |
| 41C | 5,000 | 2,998 | 6,736 | 1,327 | 1,327 |
| 44B | 1,194 | 1,194 | 1,194 | 1,194 | 1,194 |
| 45B | N/A | 377 | N/A | 377 | 377 |
| 45D | 2,235 | 4,009 | 2,235 | 2,181 | 2,806 |
| 45L | 7,500 | 13,415 | 10,814 | 11,801 | 2,228 |
| 63D | 533 | 537 | 533 | 1,014 | 1,014 |
| 63G | 694 | 694 | 694 | 694 | 694 |
| 63H | 1,178 | 1,178 | 1,178 | 2,297 | 1,885 |
| 63J | N/A | 878 | N/A | 878 | 878 |
| TOTAL | 118,834 | 130,083 | 129,071 | 134,662 | 107,344 |

# PERSONNEL REQUIREMENTS ANALYSIS



# PERSONNEL: TOTAL REQUIREMENT

| MOS | PREDECESSOR | BCS | Proposed System Alternatives ALT 1 | ALT 2 | ALT 3 |
|---|---|---|---|---|---|
| 13B | 25,500 | 16,712 | 27,731 | 26,766 | 16,712 |
| 31E | 100 | 1,664 | 499 | 499 | 1,664 |
| 31S | N/A | 399 | N/A | N/A | 399 |
| 31V | N/A | 796 | N/A | 198 | 796 |
| 32G | N/A | 527 | N/A | N/A | 527 |
| 34Y | N/A | 82 | N/A | 82 | 82 |
| 35C | N/A | 379 | N/A | 46 | 46 |
| 35E | N/A | 1,244 | N/A | 109 | 146 |
| 35H | N/A | 40 | N/A | - | 40 |
| 41C | 125 | 333 | 865 | 133 | 133 |
| 44B | 70 | 70 | 70 | 70 | 70 |
| 45B | 133 | 133 | - | 133 | 133 |
| 45D | 1,200 | 1,806 | 1,004 | 1,003 | 1,157 |
| 45L | 3,500 | 3,005 | 3,005 | 3,005 | 4111 |
| 63D | 46 | 134 | 134 | 307 | 307 |
| 63G | 67 | 67 | 67 | 67 | 67 |
| 63H | 155 | 155 | 155 | 310 | 252 |
| 63J | 304 | 304 | - | 126 | 304 |
| TOTAL | 31,200 | 27,850 | 33,530 | 32,854 | 26,946 |

# PERSONNEL: STRUCTURE BY PAYGRADE

| | | | Proposed System Alternatives | | |
|---|---|---|---|---|---|
| PAYGRADE | PREDECESSOR | RCS | ALT 1 | ALT 2 | ALT 3 |
| E-1 | 6,000 | 5,341 | 5,948 | 6,075 | 4,296 |
| E-2 | 4,500 | 4,157 | 4,799 | 4,887 | 3,449 |
| E-3 | 7,000 | 5,690 | 6,643 | 6,785 | 4,673 |
| E-4 | 9,500 | 7,612 | 9,575 | 9,614 | 6,354 |
| E-5 | 2,700 | 3,495 | 3,954 | 3,847 | 2,870 |
| E-61 | 1,500 | 1,604 | 2,662 | 1,696 | 1,604 |
| TOTAL | 31,200 | 27,899 | 33,581 | 32,904 | 23,246 |

# PERSONNEL: ANNUAL RECRUITS

| | | | Proposed System Alternatives | | |
|---|---|---|---|---|---|
| MOS | PREDECESSOR | BCS | ALT 1 | ALT 2 | ALT 3 |
| 13B | 6,000 | 5,658 | 9,388 | 9,388 | 5,648 |
| 31E | 15 | 569 | 171 | 171 | 569 |
| 31S | N/A | 129 | - | - | 129 |
| 31V | N/A | 519 | - | 129 | 519 |
| 32G | N/A | 107 | - | - | 107 |
| 34Y | N/A | 36 | - | 36 | 36 |
| 35C | N/A | 77 | - | 12 | 12 |
| 35E | N/A | 523 | - | 46 | 61 |
| 35H | N/A | 17 | - | - | 17 |
| 41C | 50 | 124 | 322 | 50 | 50 |
| 44B | 62 | 62 | 62 | 62 | 62 |
| 45B | 37 | 37 | - | 37 | 37 |
| 45D | 375 | 660 | 367 | 367 | 423 |
| 45L | 1,200 | 1,132 | 1,132 | 1,132 | 152 |
| 63D | 58 | 58 | 58 | 118 | 118 |
| 63H | 75 | 75 | 75 | 150 | 122 |
| 63J | 89 | 89 | - | 89 | 89 |
| TOTAL | 7,961 | 9,872 | 11,575 | 11,787 | 8,151 |

A comparison of the personnel demands of a new system to available personnel resources can indicate three conditions: (1) a surplus of resources relative to demand, (2) a shortage of resources, or (3) projected resources are adequate to meet demand. In Impact Analysis, the first condition is called a surplus, the second a shortfall, and the third condition is referred to as neutral.

The types of personnel data, authorizations and availability, were used to make supply/demand comparison. Authorizations are those manpower positions, or spaces, for which the Army has received (or must request) funding authority from the Congress. Thus, authorizations constitute a statement of the Army's demand for manpower. Availability, on the other hand, is a statement of the personnel system's ability to fill the authorized positions with individuals. In any current year, availability is a statement of personnel inventory on-hand. In a future year, it is an estimate of future supply.

It must be noted that authorizations do not reflect the force structure required to satisfy the various missions with which the Army has been tasked. In peacetime, the Army chooses not to man (i.e., authorize) 100 percent of its units at 100 percent of their force structure requirement, in order to divert resources to other priority objectives. Consequently, authorizations are usually lower than requirements; stated another way, the manpower demand reflected by requirements is almost always higher than that reflected by authorizations. It is not possible to make an analysis of how an emerging system's manpower requirements impact on the total force structure requirements without knowing how the force structure requirement is allocated to the various systems and MOSs.

It is, however, possible to determine impact of a new system for a supply/demand comparison based on authorizations. An availability ratio (AR) may thus be calculated using the equation:

$$AR = \frac{(\text{Availability}) \times (1 - \%\ \text{TTHS})}{\text{Authorizations} \times (1 - \%\ \text{TTHS}) + \text{New System Manpower}}$$

where:

$AR > 1$ = Shortfall
$AR < 1$ = Surplus
$AR = 1$ = Neutral

An example of an availability ratio table is shown in Figure II-51.

G. MODULE 7 - TRADEOFF ANALYSIS. The Tradeoff Analysis provides for the analysis of the critical "high driver" issues that result from the output of the impact analysis to define acceptable alternatives. Tradeoff changes and results are the output of this analysis. Tradeoff analysis can take into consideration equipment, ammunition, reliability and maintainability mission variables. Additionally, HARDMAN data and analysis results support the Logistic Support Analysis procedures of Military Standard 1388-1A, the Individual and Collective Training Plan (ICTP), the Qualitative and Quantitative Personnel Requirements Information (QQPRI), and the Cost and Training Effectiveness Analysis (CTEA) processes. Specific examples of this support are shown in Figures II-52 through II-55.

AD-A164 628 ARMY HARDMAN FAMILIARIZATION REPORT(U) DYNAMICS RESEARCH CORP WILMINGTON MA R B WESSLING ET AL. JAN 85 E-9743U DABT60-84-C-0077



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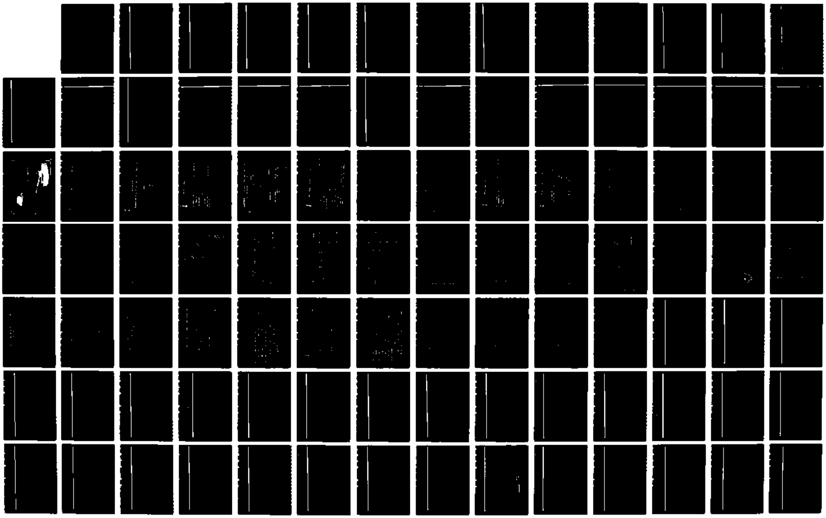
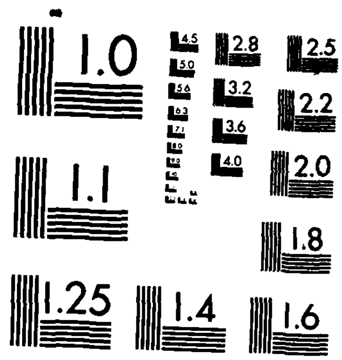



1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0

# IMPACT: AVAILABILITY RATIO

| | | | Proposed System Alternatives | | |
|---|---|---|---|---|---|
| MOS | CURRENT | BCS | ALT 1 | ALT 2 | ALT 3 |
| 13B | .96 | 1.11 | .81 | .90 | 1.11 |
| 31E | .94 | .76 | .92 | .92 | .76 |
| 31S | 1.25 | 1.09 | - | - | 1.09 |
| 31V | 1.00 | .96 | - | .99 | .96 |
| 32G | .93 | .78 | - | - | .78 |
| 34Y | 1.05 | .99 | - | .99 | .99 |
| 35C | .70 | .45 | - | .67 | .67 |
| 35E | .92 | .40 | - | .86 | .84 |
| 35H | 1.14 | 1.13 | - | - | 1.13 |
| 41C | 1.12 | .90 | .58 | 1.07 | 1.07 |
| 44B | .96 | .95 | .95 | .95 | .95 |
| 45B | 1.05 | ..99 | - | .99 | .99 |
| 45D | 1.00 | .40 | .65 | .69 | .62 |
| 45L | .87 | .21 | .21 | .21 | .99 |
| 63D | 1.01 | 1.33 | 1.33 | 1.27 | 1.27 |
| 63G | .98 | .95 | .95 | .95 | .95 |
| 63H | 1.01 | .95 | .95 | .93 | .94 |
| 63J | .81 | .76 | | .78 | .76 |

2-89

# HARDMAN SUPPORTS:

LOGISTICS SUPPORT ANALYSIS (LSA) (MIL–STD 1388–1A)

TASK 201 = USE STUDY

TASK 203 = COMPARATIVE ANALYSIS

TASK 204 = TECHNOLOGICAL OPPORTUNITIES

TASK 205 = SUPPORTABILITY AND RELATED DESIGN FACTORS

TASK 301 = FUNCTIONAL REQUIREMENTS IDENTIFICATION

TASK 302 = SUPPORT SYSTEM ALTERNATIVES

TASK 303 = ALTERNATIVE EVALUATION AND TRADEOFFS

TASK 401 = TASK ANALYSIS

TASK 402 = EARLY FIELDING ANALYSIS

# HARDMAN SUPPORTS:

INDIVIDUAL AND COLLECTIVE TRAINING PLAN (ICTP) (TRADOC REG. 351–9)

- TRAINING PROGRAM DESCRIPTION
- NEW EQUIPMENT TRAINING REQUIREMENTS
- INSTITUTIONAL COURSES OF INSTRUCTION
- INSTRUCTOR REQUIREMENTS
- NEW FUNDING REQUIREMENTS
- TRAINING AIDS/MEDIA REQUIREMENTS
- TRAINING DEVICE REQUIREMENTS

# HARDMAN SUPPORTS:

QUALITATIVE AND QUANTITATIVE PERSONNEL REQUIREMENTS INFORMATION
(QQPRI) (AR 71–2)

EQUIPMENT DESCRIPTION

MAINTENANCE MANHOURS

OPERATOR MANPOWER REQUIREMENTS

DUTY POSITIONS, MOS, SKILL LEVEL

DUTIES AND TASKS

TRAINING PLAN

# HARDMAN SUPPORTS:

COST AND TRAINING EFFECTIVENESS ANALYSIS (CTEA) (TRADOC TEA HANDBOOK)

ANALYZE HARDWARE

DETERMINE OPERATION TASKS

DEVELOP SOLDIER CAPABILITIES

ANALYZE SOLDIER–HARDWARE SUBSYSTEM INTERFACE

ESTIMATED COST

COURSES IMPACTED

COURSE DESCRIPTION

CHANGES TO CURRENT COSTS

STUDENT LOAD PER YEAR

AVERAGE GRADE PER STUDENT

STUDENT SOURCE

CLASS FREQUENCY

CLASS LENGTH

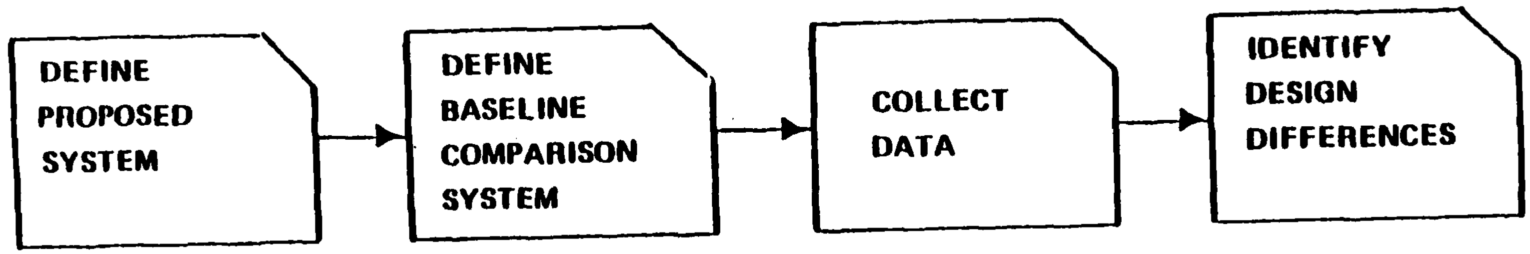
INSTRUCTOR REQUIREMENTS

V. HARDMAN APPLICATION. Examining an application of HARDMAN at a general level of performance will help to put the methodology in perspective. The "case history" is on the Division Support Weapon System (DSWS)/Howitzer Improvement Program (HIP) applications because they are representative of the methodology.

A. MODULE 1 - INTRODUCTION. The review of this application will follow the six steps of the HARDMAN Analysis. These applications sought to identify the manpower, personnel and training resource issues for the successors to the M109 series of 155-mm self-propelled Howitzers. The specific details of all steps/assumptions for this study are found in the report entitled "Application of the HARDMAN Methodology to the Howitzer Improvement Program (HIP)," dated March 1984. Copies of this report, can be obtained by contacting the Soldier Support Center, NCR, ATTN: ATZI-NCM, 200 Stovall Street, Alexandria, Virginia 22332.

B. MODULE 2 - SYSTEMS ANALYSIS. The Systems Analysis step developed the mission requirements both general and specific, and established the predecessor system, baseline comparison system, and the proposed systems characters by equipments, functions, and tasks. These outputs were the result of the use of the basic approach for comparability analysis defined earlier. The specifics of the comparability basis are shown in Figure II-56. The documentation for these analyses was identified and reviewed for incorporation into the consolidated data base through the use of a data collection plan. A slice of the comparability analysis for the Howitzer Improvement Program (HIP) would use the same analysis approach beginning with the definition of the proposed system (HIP) and the definition of the baseline comparison system through appropriate data

# HIP EQUIPMENT COMPARABILITY ANALYSIS




**DEFINE PROPOSED SYSTEM**

- FIRE SUPPORT MAA
- HIP MSRS
- HIP O&O
- DSWS/ESPAWS STUDIES

**DEFINE BASELINE COMPARISON SYSTEM**

- M109 A2/A3 (PREDECESSOR)
- USN/USAF EQUIPMENTS
- OTHER EXISTING EQUIPMENT

**COLLECT DATA**

- SAMPLE DATA COLLECTION
- NORDEN LSAR
- ARI HOWITZER CREW MODEL

**IDENTIFY DESIGN DIFFERENCES**

- ARMAMENT
- FIRE CONTROL
- COMMUNICATIONS
- HYDRAULICS
- ELECTRICAL
- AMMUNITION LOADING
- SUSPENSION
- STE/ICE

collection means. The sample data collection program, NORDEN LSAR and ARI developed Howitzer crew model served this purpose. The results were the identification of the design differences by function and system mission requirements.

All of the alternatives were provided the same treatment. The scenario assumptions, which were cited in the HIP O&O plan included wartime usage using a 24 hour day for 7 day period to exercise the proposed system for a reasonable period of time to use for data generation purposes. The HIP is to fire 372 rounds per tube per day which is a composite of surge, intense, and sustained rates. The HIP is to move 28 miles per self propelled howitzer (SPH) per day. A total of 13 miles would be for tactical positioning and 15 miles for unit moves. The electronics would be operating 24 hours per day.

The force structure or basis of issue assumptions included 8 SPH per battery with 3 batteries per battalion and 3 battalions per division. With the mission requirements identified, the equipment structure defined, and the functional allocations performed to generate the tasks the analysis proceeds to the manpower requirements analysis.

C. MODULE 3 - MANPOWER RESULTS. The determination of the initial MOS requirements are refined by the workload analysis for both operators and maintainers. The computations for the force structure and manpower requirements are measured against the workload capacity and the final determination of manpower requirements. This data is arrayed by crew for each system alternative. It is also presented by MOS for unit maintenance; and intermediate maintenance, both forward and rear. The force structure summaries provide the level (battery, battalion and

division) data based on crew and maintenance level requirements. Also provided is the current authorizations as they are contrasted with the system alternative based on the total SPH requirement. Finally an assessment of all the manpower requirements are presented graphically in a bar graph for visual comparison of the manpower requirements based upon the system design and scenario. Output of the manpower assessment are shown in Figures II-57 through II-62.

D. MODULE 4 - TRAINING RESULTS. The Training Resource Requirements Analysis begins with the identification of existing training and the evaluation of applicability of predecessor tasks. The routines that follow establish the BCS tasks and evaluate these tasks as the new tasks are developed to establish the proposed system tasks. These tasks are assigned to training and training settings. Next, the course requirements analysis identifies the applicable existing courses of instruction and evaluates the validity of these courses and/or their annexes to be used for construction of the Quasi-POI(s). Using this data the number of instructors, training man-days, and institutional course costs can be identified. These routines also cue other training resource requirements to include providing a listing of candidate training devices. This output is formatted to provide understandable data which generally conforms to data requirements specified by TRADOC, and is shown in Figure II-63 through II-67.

E. MODULE 5 - PERSONNEL RESULTS. The Personnel Requirements Analysis uses the manpower requirements as a starting point for the analysis of the pipeline characteristics and flow rates to compute the personnel requirements. These requirements are structured to reflect the requirements by MOS for each alternative. They are also

# MANPOWER: CREW

| | CURRENT TOE* | SYSTEM ALTERNATIVES | | |
|---|---|---|---|---|
| | | BCS | HELP | HIP |
| SUSTAINED REQUIREMENT (1 SPH) | 9 | 7 | 12 | 7 |
| BATTERY REQUIREMENT (1 x 8 SPH) | 72 | 56 | 96 | 56 |
| BATTALION REQUIREMENT (3 x 8 SPH) | 216 | 168 | 288 | 168 |

*FA BN, HVY DIV, TOE 06365J210
MODIFIED BY TRADOC
VALUES ARE M109-SPECIFIC

# MANPOWER: UNIT MAINTENANCE
# (24 SPH)

| MOS | CURRENT TOE* | SYSTEM ALTERNATIVES | | |
|---|---|---|---|---|
| | | BCS | HELP | HIP |
| 31V | 0 | 8 | 2 | 8 |
| 35E | 0 | 16 | 1 | 1 |
| 45D | 6 | 13 | 14 | 5 |
| 63D | 6 | 2 | 4 | 3 |
| 63J | 0 | 1 | 1 | 1 |
| TOTAL | 12 | 40 | 22 | 18 |

* FA BN, HVY DIV, TOE 06365J210
VALUES ARE M109-SPECIFIC

# MANPOWER: INTERMEDIATE MAINTENANCE - FORWARD (72 SPH)

| MOS | CURRENT TOE* | SYSTEM ALTERNATIVES | | |
|---|---|---|---|---|
| | | BCS | HELP | HIP |
| 31E | 9 | 23 | 10 | 23 |
| 31S | 0 | 6 | 0 | 6 |
| 34Y | 6 | 1 | 1 | 1 |
| 35E | 9 | 27 | 1 | 1 |
| 35H | 0 | 1 | 0 | 1 |
| 41C | 6 | 1 | 1 | 1 |
| 44B | 0 | 1 | 1 | 1 |
| 45B | 3 | 2 | 2 | 2 |
| 45L | 15 | 65 | 65 | 10 |
| 63G | 9 | 1 | 1 | 1 |
| 63H | 42 | 1 | 8 | 5 |
| 63J | 3 | 3 | 1 | 3 |
| TOTAL | 102 | 132 | 91 | 55 |

*MAINT CO, FWD SPT BN, HVY DIV
TOE 43004J200
VALUES INCLUDE SUPPORT FOR OTHER LINs

# MANPOWER: FORCE STRUCTURE SUMMARIES

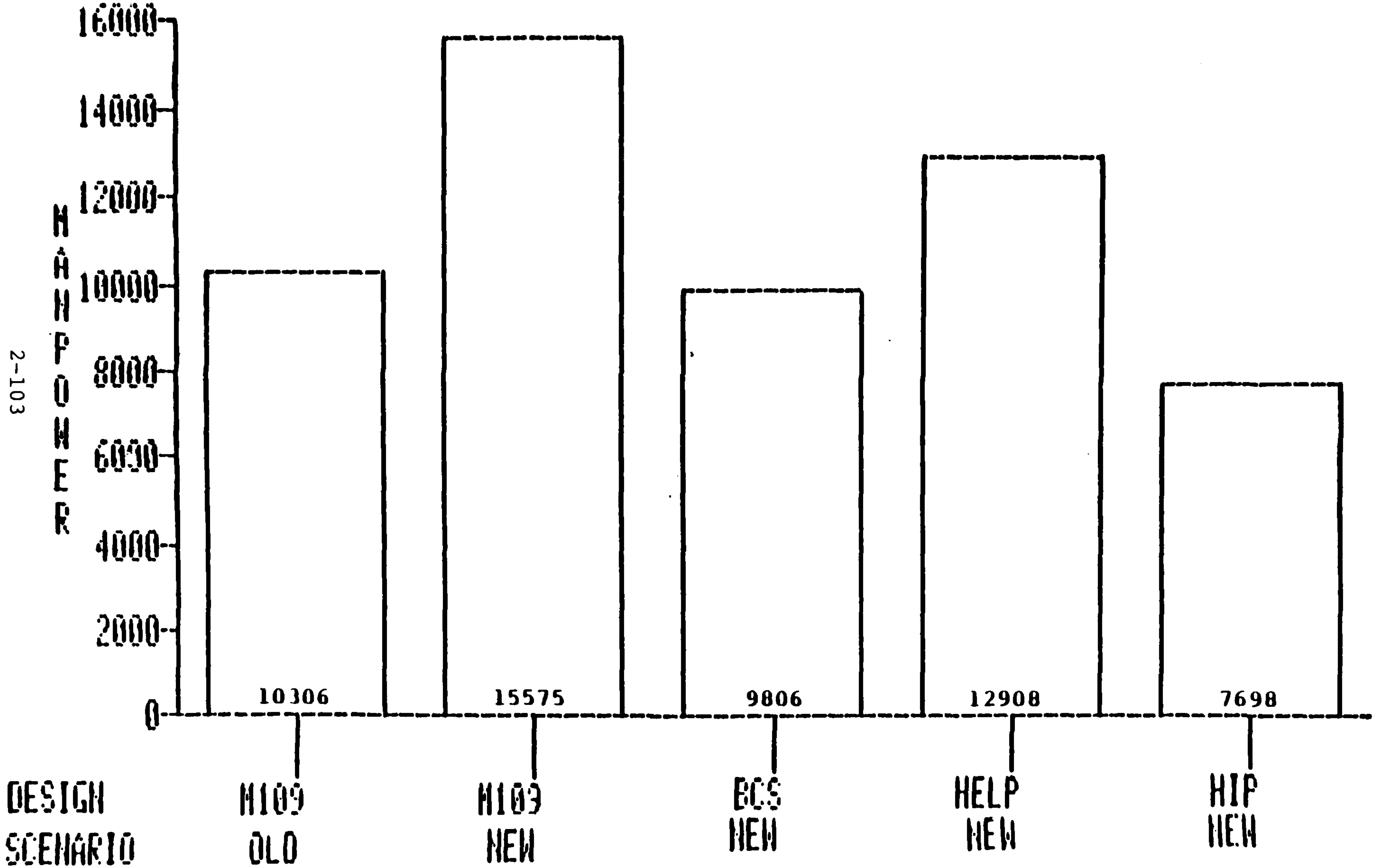
| LEVEL | BASIS | CURRENT TOE* | BCS | HELP | HIP |
|---|---|---|---|---|---|
| | | | SYSTEM ALTERNATIVES | | |
| BATTERY | 8 CREWS | 72 | 56 | 96 | 56 |
| BATTALION | 24 CREWS | 216 | 168 | 288 | 168 |
| | 1 UNIT MAINTENANCE | 12 | 40 | 22 | 18 |
| | TOTAL BATTALION | 228 | 208 | 310 | 186 |
| DIVISION | 72 CREWS | 648 | 504 | 864 | 504 |
| | 3 UNIT MAINTENANCE | 36 | 120 | 66 | 54 |
| | 1 IMA-FORWARD | 102 | 132 | 91 | 55 |
| | TOTAL DIVISION | 786 | 756 | 1021 | 613 |

*FA BN, HVY DIV, TOE 06365J210
MODIFIED BY TRADOC

# MANPOWER: TOTAL REQUIREMENT (848 SPH)

| MOS | CURRENT AUTHORIZATIONS | SYSTEM ALTERNATIVES: BCS | HELP | HIP 1/ |
|---|---|---|---|---|
| 13B | 8,820 | 5,936 | 10,176 | 5,936 |
| 31E | 2 | 456 | 120 | 456 |
| 31S | 0 | 72 | 0 | 72 |
| 31V | 0 | 282 | 70 | 282 |
| 32G | 0 | 96 | 0 | 96 |
| 34Y | 0 | 24 | 24 | 24 |
| 35C | 0 | 192 | 12 | 12 |
| 35E | 0 | 324 | 12 | 12 |
| 35H | 0 | 12 | 0 | 12 |
| 41C | 15 | 120 | 36 | 36 |
| 44B | 0 | 24 | 24 | 24 |
| 45B | 7 | 24 | 24 | 24 |
| 45D | 343 | 459 | 494 | 176 |
| 45L | 244 | 1,548 | 1,548 | 216 |
| 63D | 518 | 70 | 141 | 105 |
| 63G | 0 | 24 | 24 | 24 |
| 63H | 357 | 72 | 156 | 120 |
| 63J | 0 | 71 | 47 | 71 |
| TOTAL | 10,306 | 9,806 | 12,908 | 7,698 |

# TOTAL MANPOWER REQUIREMENTS - ALL MOSs



# COURSE IMPACTS MAN-DAYS

| MOS | PREDECESSOR | BCS | HELP | HIP |
|---|---|---|---|---|
| 13B | 0 | 5.3 | 4.6 | 5.3 |
| 31E | 0 | 1.7 | 0 | 8.8 |
| 31S | N/A | 3.8 | N/A | 1.9 |
| 31V | N/A | 0.2 | 0.8 | −2.9 |
| 32G | N/A | 5.1 | N/A | 1.5 |
| 34Y | N/A | 8.9 | 6.8 | 8.9 |
| 35C | N/A | 0 | 0 | 0 |
| 35E | N/A | 9.7 | 6.1 | 9.7 |
| 35H | N/A | 0 | N/A | 0 |
| 41C | 0 | 0 | 0 | 0 |
| 44B | 0 | 0 | 0 | 0 |
| 45B | N/A | 0 | 0 | 0 |
| 45D | 0 | 5.6 | 0 | 5.6 |
| 45L | 0 | 15.1 | 5.1 | 8.5 |
| 63D | 0 | 0.6 | 0.6 | 0.6 |
| 63G | 0 | 0 | 0 | 0 |
| 63H | 0 | 0 | 0 | 0 |
| 63J | N/A | 0 | 0 | 0 |
| TOTAL | 0 | 56.0 | 24.0 | 47.9 |

# ANNUAL TRAINING MAN-DAY REQUIREMENTS
# (K)

| MOS | BCS | HELP | HIP |
|---|---|---|---|
| 13B | 501.7 | 822.3 | 501.7 |
| 31E | 81.2 | 24.2 | 87.2 |
| 31S | 10.1 | N/A | 9.8 |
| 31V | 27.9 | 7.1 | 26.2 |
| 32G | 20.2 | N/A | 19.8 |
| 34Y | 5.2 | 4.9 | 5.2 |
| 35C | 8.4 | 1.3 | 1.3 |
| 35E | 52.9 | 4.5 | 6.2 |
| 35H | 3.5 | N/A | 3.5 |
| 41C | 14.2 | 5.7 | 5.7 |
| 44B | 4.3 | 4.3 | 4.3 |
| 45B | 1.4 | 1.4 | 1.4 |
| 45D | 20.8 | 9.7 | 13.3 |
| 45L | 74.8 | 63.1 | 8.9 |
| 63D | 2.2 | 4.5 | 4.5 |
| 63G | 2.0 | 2.0 | 2.0 |
| 63H | 2.9 | 5.7 | 4.7 |
| 63J | 3.9 | 3.9 | 3.9 |
| TOTAL | 837.6 | 964.6 | 709.6 |

II-64

# ANNUAL INSTRUCTOR REQUIREMENTS

| MOS | BCS | HELP | HIP |
|---|---|---|---|
| 13B | 244 | 400 | 244 |
| 31E | 85 | 28 | 92 |
| 31S | 13 | N/A | 13 |
| 31V | 30 | 8 | 28 |
| 32G | 21 | N/A | 20 |
| 34Y | 2 | 2 | 2 |
| 35C | 14 | 2 | 2 |
| 35E | 54 | 5 | 7 |
| 35H | 2 | N/A | 2 |
| 41C | 15 | 6 | 6 |
| 44B | 5 | 5 | 5 |
| 45B | 2 | 2 | 2 |
| 45D | 35 | 14 | 23 |
| 45L | 104 | 101 | 17 |
| 63D | 1 | 3 | 3 |
| 63G | 2 | 2 | 2 |
| 63H | 3 | 6 | 5 |
| 63J | 3 | 3 | 3 |
| TOTAL | 635 | 587 | 476 |

# ANNUAL TRAINING COURSE COSTS PER GRADUATE

ALTERNATIVE: HIP
MOS: 13B100SUT

| | OMA | MPA | PA | FHMA | TOTAL |
|---|---|---|---|---|---|
| INSTRUCTIONAL DEPT. | 329 | 2711 | 0 | 0 | 3040 |
| FLYING HOURS | 0 | 0 | 0 | 0 | 0 |
| OTHER | 0 | 0 | 0 | 0 | 0 |
| TROOP SUPPORT | | | | | |
| P8 | 0 | 0 | 0 | 0 | 0 |
| P2 | 0 | 0 | 0 | 0 | 0 |
| AMMUNITION | 0 | 0 | 1437 | 0 | 1437 |
| EQUIPMENT DEPREC | 0 | 0 | 357 | 0 | 357 |
| STUDENT PAY & ALLOW | 0 | 4130 | 0 | 0 | 4130 |
| TRAVEL PAY AT COURSE | 0 | 154 | 0 | 0 | 154 |
| PER DIEM AT COURSE | 0 | 0 | 0 | 0 | 0 |
| TOTAL DIRECT COST | 329 | 6995 | 1794 | 0 | 9118 |
| BASE OPERATIONS | 1847 | 599 | 0 | 0 | 2446 |
| SUPPORT COSTS | | | | | |
| TRAINING AIDS | 75 | 6 | 0 | 0 | 81 |
| OTHER | 230 | 235 | 0 | 38 | 503 |
| TOTAL INDIRECT | 2152 | 840 | 0 | 38 | 3030 |
| TOTAL DIRECT AND INDIRECT COST | 2481 | 7835 | 1794 | 38 | 12148 |

# ANNUAL TRAINING COSTS REQUIREMENTS
# ($K)

| MOS | BCS | HELP | HIP |
|---|---|---|---|
| 13B | 68,750 | 104,535 | 68,750 |
| 31E | 13,844 | 4,672 | 14,785 |
| 31S | 1,491 | N/A | 1,458 |
| 31V | 3,914 | 1,039 | 3,735 |
| 32G | 2,769 | N/A | 2,721 |
| 34Y | 1,005 | 974 | 1,005 |
| 35C | 2,570 | 583 | 583 |
| 35E | 10,018 | 1,096 | 1,462 |
| 35H | 442 | N/A | 442 |
| 41C | 2,998 | 1,327 | 1,327 |
| 44B | 1,194 | 1,194 | 1,194 |
| 45B | 377 | 377 | 377 |
| 45D | 4,009 | 2,181 | 2,806 |
| 45L | 13,415 | 11,801 | 2,228 |
| 63D | 537 | 1,014 | 1,014 |
| 63G | 694 | 694 | 694 |
| 63H | 1,178 | 2,297 | 1,885 |
| 63J | 878 | 878 | 878 |
| TOTAL | 130,083 | 134,662 | 107,344 |

reflected in a readout of annual recruit requirements. Examples of the output are "steady state" oriented and are shown in Figures II-68 and II-69.

F. MODULE 6 - IMPACT RESULTS. The Impact Analysis (step 5) provides for the establishment of resource availability. These computations form the basis for determining the critical requirements which are measured first against the alternatives (proposed system) and then against the force level to scope out the "high drivers" at the appropriate levels. The output could be a listing by MOS of the personnel availability. This availability is determined by dividing the total Army authorizations by the total Army availability for each MOS. This computation is performed for each MOS by the proposed system alternative. It thus allows for identification of the impacts in like terminology and is shown in Figures II-70 through II-72.

G. MODULE 7 - TRADEOFF RESULTS. The Tradeoff Analysis uses the output of the impact analysis for each issue to begin its requirements. The availability ratios are compared between proposed systems by MOS to establish ranking or ordering of the alternatives as shown on Figure II-72. This procedure would provide concrete and viable results to the decision makers. They could then apply their expertise and judgement to the identification of a course of action for the selection of the correct criteria in the area of manpower, personnel and training resources as it applies to system design, operation, and supportability.

# PERSONNEL: STRUCTURE REQUIREMENTS BY MOS

| MOS | BCS | HELP | HIP |
|---|---|---|---|
| 13B | 16,712 | 26,766 | 16,712 |
| 31E | 1,664 | 499 | 1,664 |
| 31S | 399 | — | 399 |
| 31V | 796 | 198 | 796 |
| 32G | 527 | — | 527 |
| 34Y | 82 | 82 | 82 |
| 35C | 379 | 46 | 46 |
| 35E | 1,244 | 109 | 146 |
| 35H | 40 | — | 40 |
| 41C | 333 | 133 | 133 |
| 44B | 70 | 70 | 70 |
| 45B | 133 | 133 | 133 |
| 45D | 1,806 | 1,003 | 1,157 |
| 45L | 3,055 | 3,055 | 411 |
| 63D | 134 | 307 | 307 |
| 63G | 67 | 67 | 67 |
| 63H | 155 | 310 | 252 |
| 63J | 304 | 126 | 304 |
| TOTAL | 27,900 | 32,904 | 23,246 |

# ANNUAL RECRUITS

| MOS | BCS | HELP | HIP |
|---|---|---|---|
| 13B | 5,658 | 9,388 | 5,658 |
| 31E | 569 | 171 | 569 |
| 31S | 129 | — | 129 |
| 31V | 519 | 129 | 519 |
| 32G | 107 | — | 107 |
| 34Y | 36 | 36 | 36 |
| 35C | 77 | 12 | 12 |
| 35E | 523 | 46 | 61 |
| 35H | 17 | — | 17 |
| 41C | 124 | 50 | 50 |
| 44B | 62 | 62 | 62 |
| 45B | 37 | 37 | 37 |
| 45D | 660 | 367 | 423 |
| 45L | 1,132 | 1,132 | 152 |
| 63D | 58 | 118 | 118 |
| 63G | 44 | 44 | 44 |
| 63H | 75 | 150 | 122 |
| 63J | 89 | 89 | 89 |
| TOTAL | 9,916 | 11,831 | 8,205 |

# PERSONNEL AVAILABILITY
# CURRENT PROJECTIONS FOR 1986

| MOS | AVAILABILITY Total Army | AUTHORIZATIONS Total Army | AVAILABILITY RATIO |
|---|---|---|---|
| 13B | 20,645 | 21,492 | .96 |
| 31E | 1,434 | 1,424 | 1.01 |
| 31S | 640 | 513 | 1.25 |
| 31V | 6,158 | 6,153 | 1.00 |
| 32G | 449 | 481 | .93 |
| 34Y | 369 | 350 | 1.05 |
| 35C | 200 | 285 | .70 |
| 35E | 453 | 494 | .92 |
| 35H | 1,132 | 990 | 1.14 |
| 41C | 491 | 439 | 1.12 |
| 44B | 1,411 | 1,464 | .96 |
| 45B | 502 | 476 | 1.05 |
| 45D | 409 | 408 | 1.00 |
| 45L | 365 | 422 | .87 |
| 63D | 1,879 | 1,863 | 1.01 |
| 63G | 772 | 785 | .98 |
| 63H | 5,183 | 5,753 | 1.01 |
| 63J | 885 | 1,087 | .81 |

Source: MILPERCEN $P^3M$ Model.

# M109-DRIVEN AUTHORIZATIONS

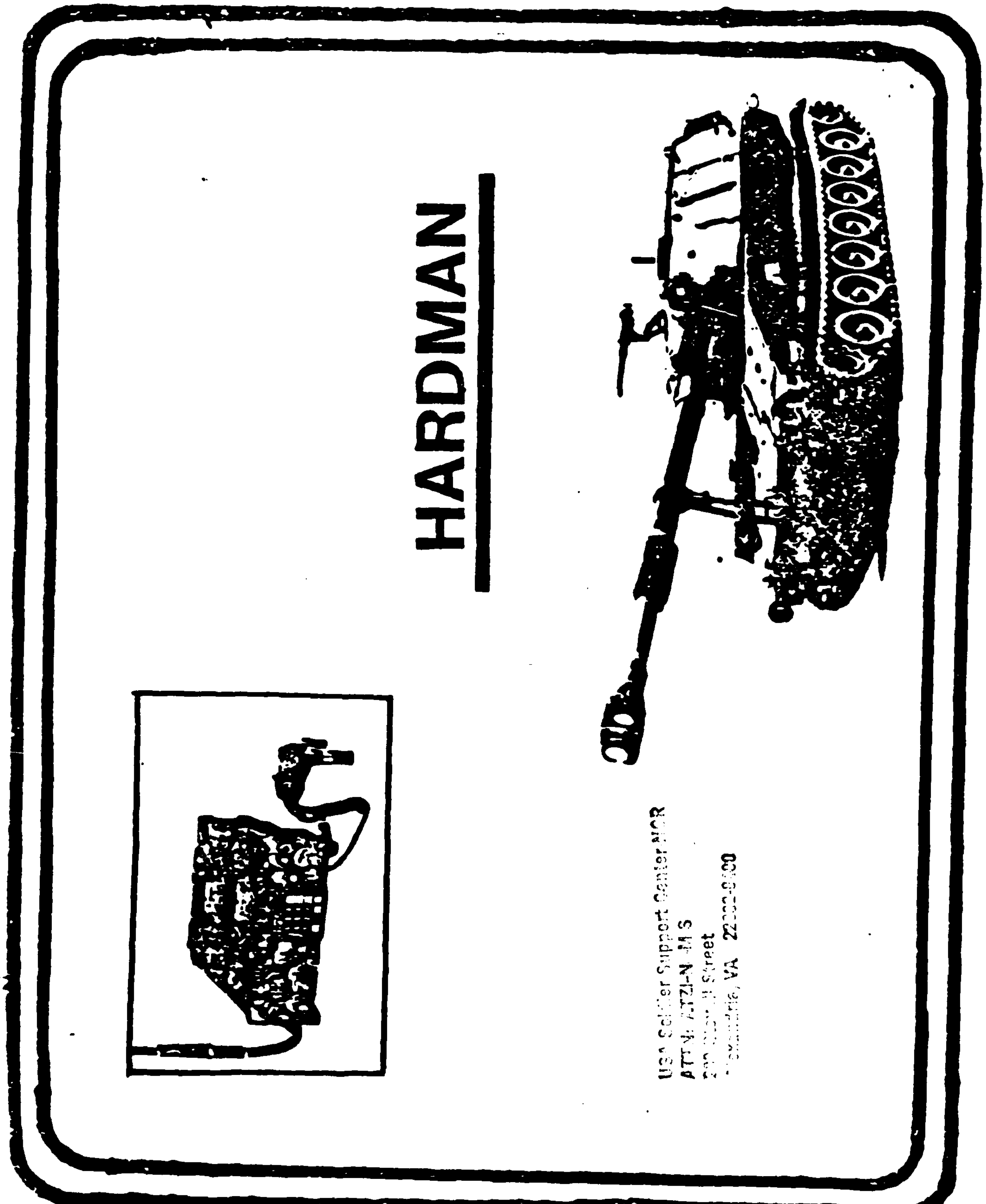
| MOS | FY 1986 AUTHORIZATIONS TOTAL | M109 | % of TOTAL |
|---|---|---|---|
| 13B | 21,492 | 8,820 | 41 |
| 31E | 1,424 | 2 | — |
| 31S | 513 | 0 | — |
| 31V | 6,153 | 0 | — |
| 32G | 481 | 0 | — |
| 34Y | 350 | 0 | — |
| 35C | 285 | 0 | — |
| 35E | 494 | 0 | — |
| 35H | 990 | 0 | — |
| 41C | 439 | 15 | 3 |
| 44B | 1,464 | 0 | — |
| 45B | 476 | 7 | 1 |
| 45D | 408 | 343 | 84 |
| 45L | 422 | 244 | 58 |
| 63D | 1,863 | 518 | 28 |
| 63G | 785 | 0 | — |
| 63H | 5,753 | 357 | 6 |
| 63J | 1,087 | 0 | — |

II-71

# AVAILABILITY RATIO IMPACTS

| | | PROJECTED | | | |
|---|---|---|---|---|---|
| MOS | CURRENT | M109 | BCS | HELP | HIP |
| 13B | .96 | .81 | 1.11 | .90 | 1.11 |
| 31E | .94 | .92 | .76 | .92 | .76 |
| 31S | 1.25 | — | 1.09 | — | 1.09 |
| 31V | 1.00 | — | .96 | .99 | .96 |
| 32G | .93 | — | .78 | — | .78 |
| 34Y | 1.05 | — | .99 | .99 | .99 |
| 35C | .70 | — | .45 | .67 | .67 |
| 35E | .92 | — | .40 | .86 | .84 |
| 35H | 1.14 | — | 1.13 | — | 1.13 |
| 41C | 1.12 | .58 | .90 | 1.07 | 1.07 |
| 44B | .96 | .95 | .95 | .95 | .95 |
| 45B | 1.05 | — | .99 | .99 | .99 |
| 45D | 1.00 | .65 | .40 | .69 | 1.70 |
| 45L | .87 | .21 | .21 | .21 | .99 |
| 63D | 1.01 | 1.33 | 1.33 | 1.27 | 1.27 |
| 63G | .98 | .95 | .95 | .95 | .95 |
| 63H | 1.01 | .95 | .95 | .93 | .94 |
| 63J | .81 | — | .76 | .78 | .76 |

ANNEX A



## HARDMAN FAMILIARIZATION BRIEFING SERIES

WHAT: ONE DAY SEMINARS
29 LOCATIONS

WHEN: JAN 85 - SEP 85

PURPOSE: FAMILIARIZE THE ARMY MATERIAL ACQUISITION COMMUNITY WITH THE ARMY HARDMAN METHODOLOGY

PARTICIPANTS:

SSC - NCR

DYNAMICS RESEARCH CORPORATION

# MANPRINT
# MANPOWER & PERSONNEL INTEGRATION

- HUMAN FACTORS
- MANPOWER
- PERSONNEL
- TRAINING
- DOCTRINE
- MATERIEL

# WHAT IS MANPRINT??

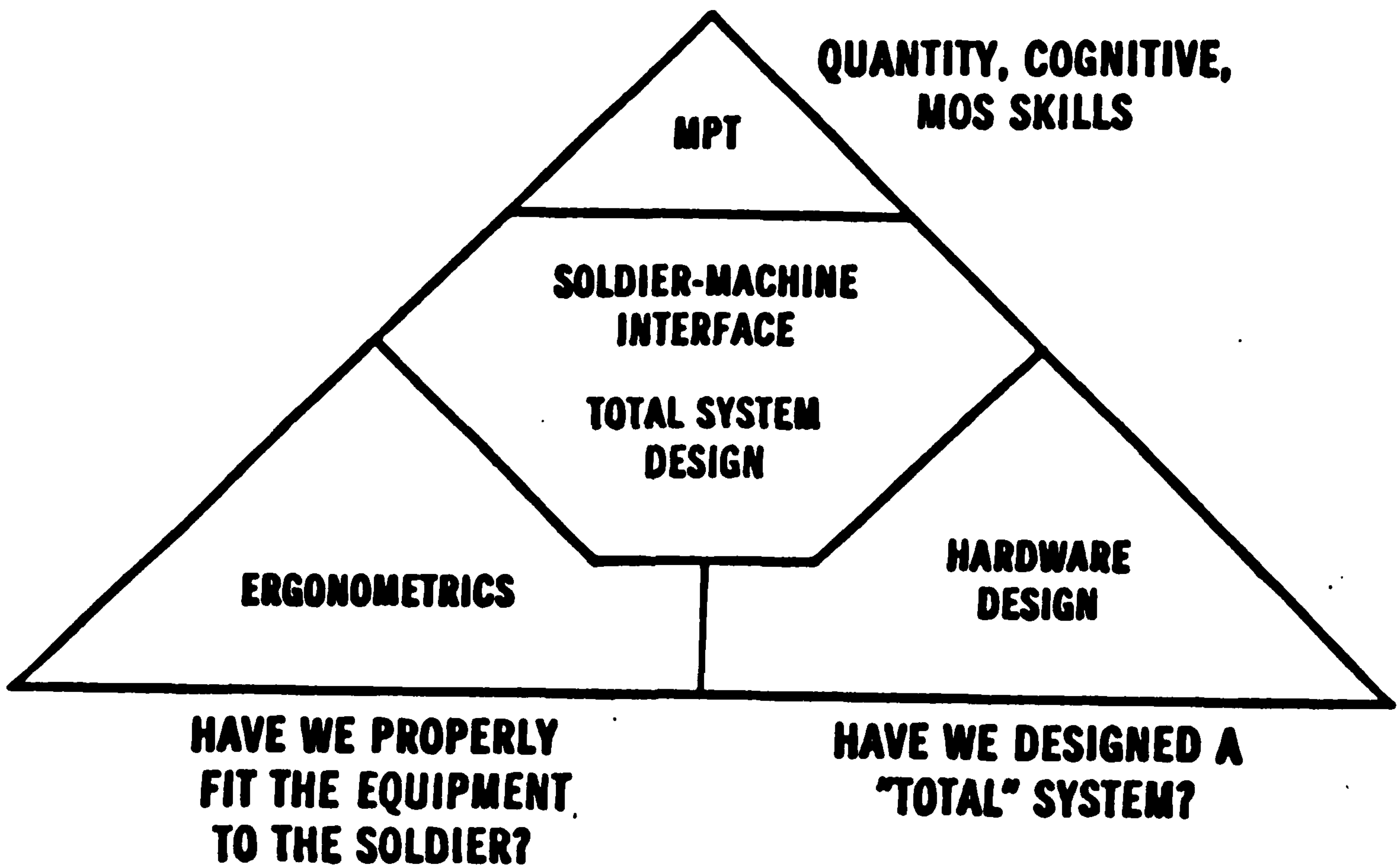
AN UMBRELLA CONCEPT THAT IDENTIFIES, ADDRESSES, AND IMPOSES . . .

- HUMAN FACTORS, SAFETY, & HEALTH
- MANPOWER,
- PERSONNEL, AND
- TRAINING . . .

CONSIDERATIONS PRIOR TO AND ACROSS THE ENTIRE MATERIEL ACQUISITION PROCESS.

- THESE CONSIDERATIONS ARE NOT NEW BUT HISTORICALLY THEY HAVE USUALLY NOT BEEN DONE VERY WELL.
- DYNAMIC CONCEPT DESIGNED TO REVITALIZE SOLDIER ASPECT OF SYSTEMS DEVELOPMENT.
- INCREASES SIGNATURE OF MANNING INTEGRATION FUNCTION.

# MANPRINT . . . IS AN ITERATIVE & MUTUALLY INTERDEPENDENT PROCESS.




- CLASSIC SYSTEMS ANALYSIS APPROACH WITH SOLDIER AND SOLDIER MACHINE INTERFACE AS THE KEYSTONE TO TOTAL SYSTEMS DESIGN.
- EQUIP THE SOLDIER VERSUS MAN THE EQUIPMENT.
- IF DONE WELL - WILL PRODUCE A SYSTEM THAT IS SUPPORTABLE BY THE PERSONNEL AND TRAINING COMMUNITIES.

# WHO ARE THE KEY PLAYERS??

- **POLICY & GUIDANCE . . .**

  ODCSPER; ODCSOPS; ODCSLOG; ODCSRDA; TSG; ARMY SCIENCE BOARD

- **DOCTRINE . . .**

  TRADOC; TSG (HSC)

- **SUSTAINING THE FORCE . . .**

  ODCSPER, ARI, MILPERCEN, USAREC; ODCSOPS

- **TRAINING . . .**

  ODCSOPS; TRADOC, TORA, CAC

- **MATERIEL ACQUISITION DECISION PROCESS . . .**

  TRADOC USERS (TDS, CDS), PROPONENTS, TSMS, CAC, LOGCEN, SSC, TRADOC TEST ACTIVITIES, TORA, OTEA; PMS, MRSA, USAMSAA, HEL, INDUSTRY; ODCSPER SAFETY CENTER

## MANPRINT INITIATIVES FROM TRADOC/AMC MANPRINT PLAN (PARTIAL LIST)

- ESTABLISH HQ, TRADOC STEERING COMMITTEE AND DA LEVEL STEERING COMMITTEE TO GUIDE/VALIDATE MANPRINT INITIATIVES
- PUBLISH TRADOC MANPRINT DIRECTIVE
- REVISE TSM JOB REQUIREMENTS
- DEVELOP POLICIES FOR INSERTION OF MANPRINT ISSUES IN REQUIREMENT DOCUMENTS AND RFP
- DEVELOP MANPRINT ANNEX FOR JOINT TRADOC/DARCOM PAM 70 - 2 (MATERIEL ACQUISITION HANDBOOK)

## MANPRINT INITIATIVES FROM TRADOC/AMC MANPRINT PLAN (PARTIAL LIST)

- HARDMAN CONTRACT/PROCEDURAL GUIDE/ROAD SHOW
- PUBLISH "A ROAD MAP FOR ADDRESSING HMPT IN THE ACQUISITION PROCESS" --- A GUIDE FOR PREPARING MANPRINT DATA FOR ASARC
- PUBLISH CHANGE TO AR 602 - 1 (HUMAN FACTORS ENGINEERING PROGRAM) SPECIFYING TRADOC AND AMC RESPONSIBILITIES FOR MANAGING HARDMAN
- MODIFICATIONS TO OTHER DA, TRADOC, AND AMC PUBLICATIONS TO REFLECT INCREASED PRIORITY OF MANPRINT ISSUES AND ADMINISTRATIVE REQUIREMENTS

# WHAT ARE PROPONENTS' KEY RESPONSIBILITIES??

- RESPONSIBLE FOR OVERSEEING ALL CHANGES IN TACTICS, TRAINING, ORGANIZATION, AND MATERIEL.
- AS THE SPECIALTY PROPONENT (AR 600-3), MUST BE AT THE BASE OF THE MANPRINT EFFORT.

- PROPONENTS AS THE INITIATOR OF A NEW OR IMPROVED SYSTEM MUST CONSIDER MANPRINT IMPACT.
- PROPONENTS ARE ACTIVELY INVOLVED. WE NEED TO ASSIST WHEREVER POSSIBLE.

# WHAT IS TRADOC'S ROLE??

**TO ENSURE MANPRINT CONSIDERATIONS & SUPPORTABILITY OF SPECIFIC SYSTEMS AND ORGANIZATIONS.**

**PRIOR TO MILESTONE I**

- **TRADOC HAS LEAD WITH AMC IN SUPPORT**

**AFTER MILESTONE I**

- **AMC HAS LEAD WITH TRADOC IN SUPPORT**

- MANPRINT IS ACROSS ENTIRE ACQUISITION PROCESS.
- MUST BE CONTINUALLY REVIEWED AND UPDATED.
- NOTE TRADOC ROLE PRIOR MILESTONE I WHICH RESTS WITH PROPONENT (TSM USUALLY NOT APPOINTED UNTIL MILESTONE I).

# TO SUMMARIZE . . .

- THE PERSONNEL COMMUNITY IS BECOMING MORE PROACTIVE IN SYSTEM ACQUISITION;
- THERE ARE MANY EFFORTS ONGOING TO ENHANCE MANPRINT.
- PROPONENTS ARE BECOMING MORE INVOLVED IN EVENTS AND PROCESSES WHERE MANPRINT MUST OCCUR.
- THE MANPRINT COMMUNITY HAS DEVELOPED A MASTER MANAGEMENT PLAN TO ACCOMPLISH MANPRINT.

# DEFINE HARDMAN

HARDWARE VS MANPOWER (HARDMAN) COMPARABILITY METHODOLOGY

- AN EXTENSIVE ANALYSIS OF ALTERNATIVE MATERIEL SYSTEM CONCEPTS THAT GENERATES RELIABLE ESTIMATES OF MANPOWER, PERSONNEL, AND TRAINING (MPT) REQUIREMENTS
- CAN BE PERFORMED PRIOR TO MILESTONE ONE AND/OR THEREAFTER
- INCLUDES IMPACT AND TRADEOFF ANALYSIS
- CURRENTLY PERFORMED BY CONTRACT

# HARDMAN HISTORY

1975 — NAVY MILITARY VS HARDMAN PROCUREMENT (HARDMAN) STUDY CONDUCTED

1977 — NAVY ESTABLISHES HARDMAN OFFICE

1982 — (MARCH) NCR ASSUMES HARDMAN OPERATIONAL AGENCY RESPONSIBILITIES

1982 — (NOVEMBER) NCR AND ARMY RESEARCH INSTITUTE (ARI) CO-SPONSOR HARDMAN EVALUATION CONTRACT

1983 — (AUGUST) JET PROPULSION LABORATORY'S EVALUATION PRELIMINARY RESULTS PRESENTED AND NCR BEGINS WORK ON ESTABLISHING HARDMAN CONTRACTING MECHANISM. ARI BEGINS WORK ON HARDMAN DEVELOPMENT AND IMPLEMENTATION ISSUES

1984 — (JUNE) HARDMAN CONTRACT AWARDED

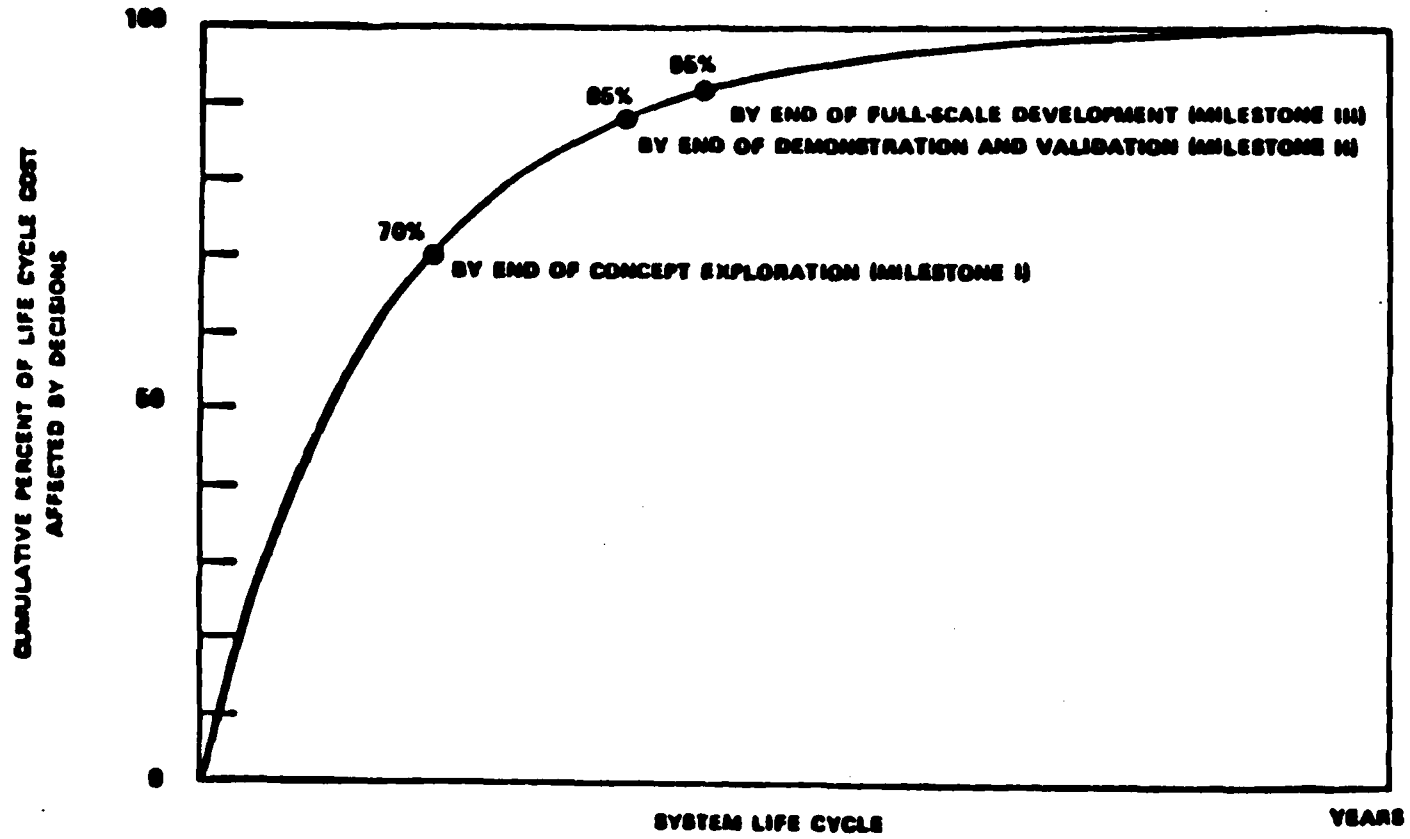
# NAVY HARDMAN STUDY

MAJOR FINDINGS:

- REQUIREMENTS FOR MANPOWER PLANNING AND TRADEOFF ANALYSIS IN THE MATERIEL ACQUISITION PROCESS OCCURRED TOO LATE AND FAILED TO ADDRESS THE MAJOR ISSUES
- KEY PARTICIPANTS IN THE ACQUISITION PROCESS OFTEN LACKED THE ANALYTICAL TOOLS NECESSARY TO DETERMINE MANPOWER AND TRAINING REQUIREMENTS EARLY IN SYSTEMS' DEVELOPMENT TO INSURE THEIR VISIBILITY

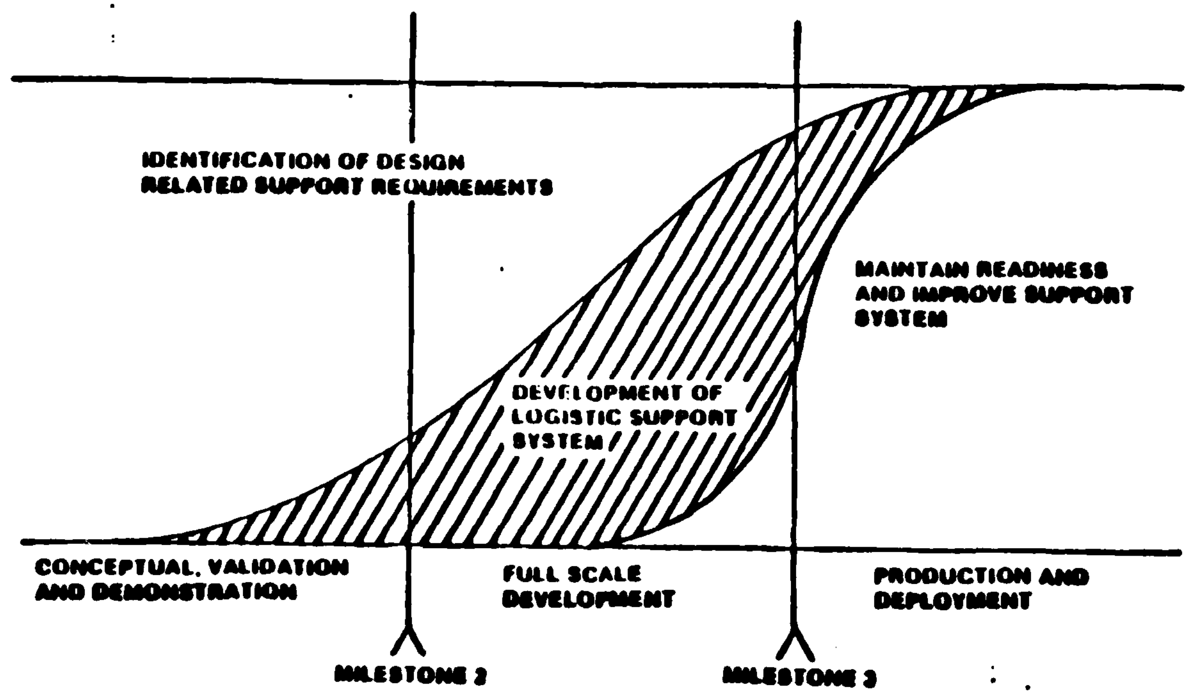
SOLUTION:

- DEVELOP ANALYTICAL TOOLS AND METHODS FOR MANPOWER, PERSONNEL AND TRAINING (MPT) TO INFLUENCE THE WEAPON SYSTEM ACQUISITION PROCESS
- DEVELOP AN MPT INFORMATION SYSTEM
- REVISE EXISTING DIRECTIVES GOVERNING THE ACQUISITION PROCESS TO BE MORE SENSITIVE TO MPT




SOURCE: Proceedings from National Security Industrial Association Symposium on Navy Systems Acquisition, October 27-28, 1977.

# SUPPORTABILITY EMPHASIS DURING ACQUISITION CYCLE



# HARDMAN
# HARDWARE VS MANPOWER

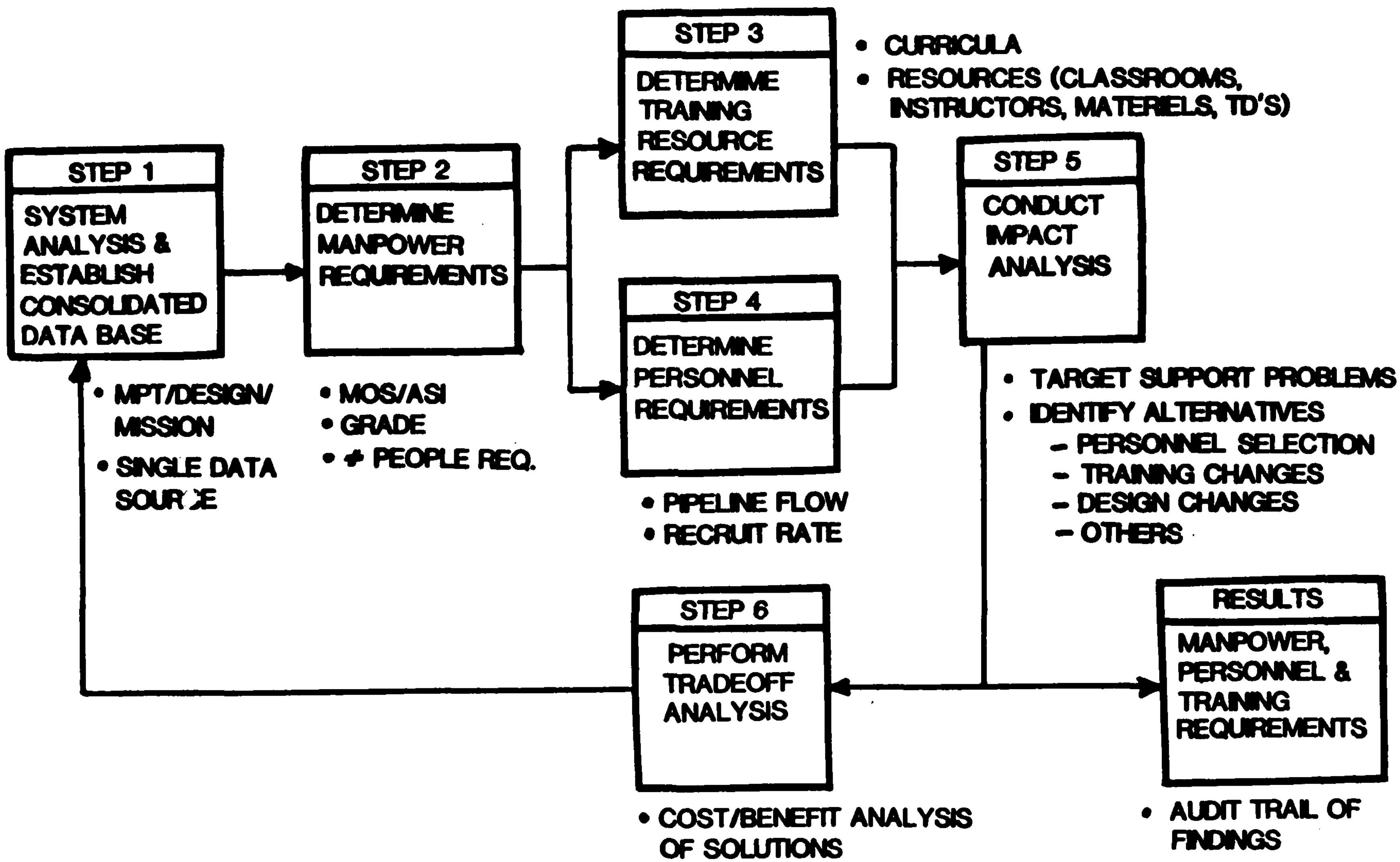
**PURPOSE:**

- TO ESTIMATE MANPOWER, PERSONNEL AND TRAINING REQUIREMENTS FOR A CONCEPTUALIZED MATERIEL SYSTEM ESPECIALLY DURING THE EARLY PHASES OF THE ACQUISITION PROCESS
- ESTIMATE THE IMPACT OF THESE MPT REQUIREMENTS ON SYSTEM EFFECTIVENESS AND LIFE CYCLE COSTS

**METHODOLOGY:**

- ESTABLISH CONSOLIDATED DATA BASE
- DETERMINE MANPOWER REQUIREMENTS
- DETERMINE TRAINING REQUIREMENTS
- DETERMINE PERSONNEL REQUIREMENTS
- CONDUCT IMPACT ANALYSIS
- PERFORM TRADEOFF ANALYSIS

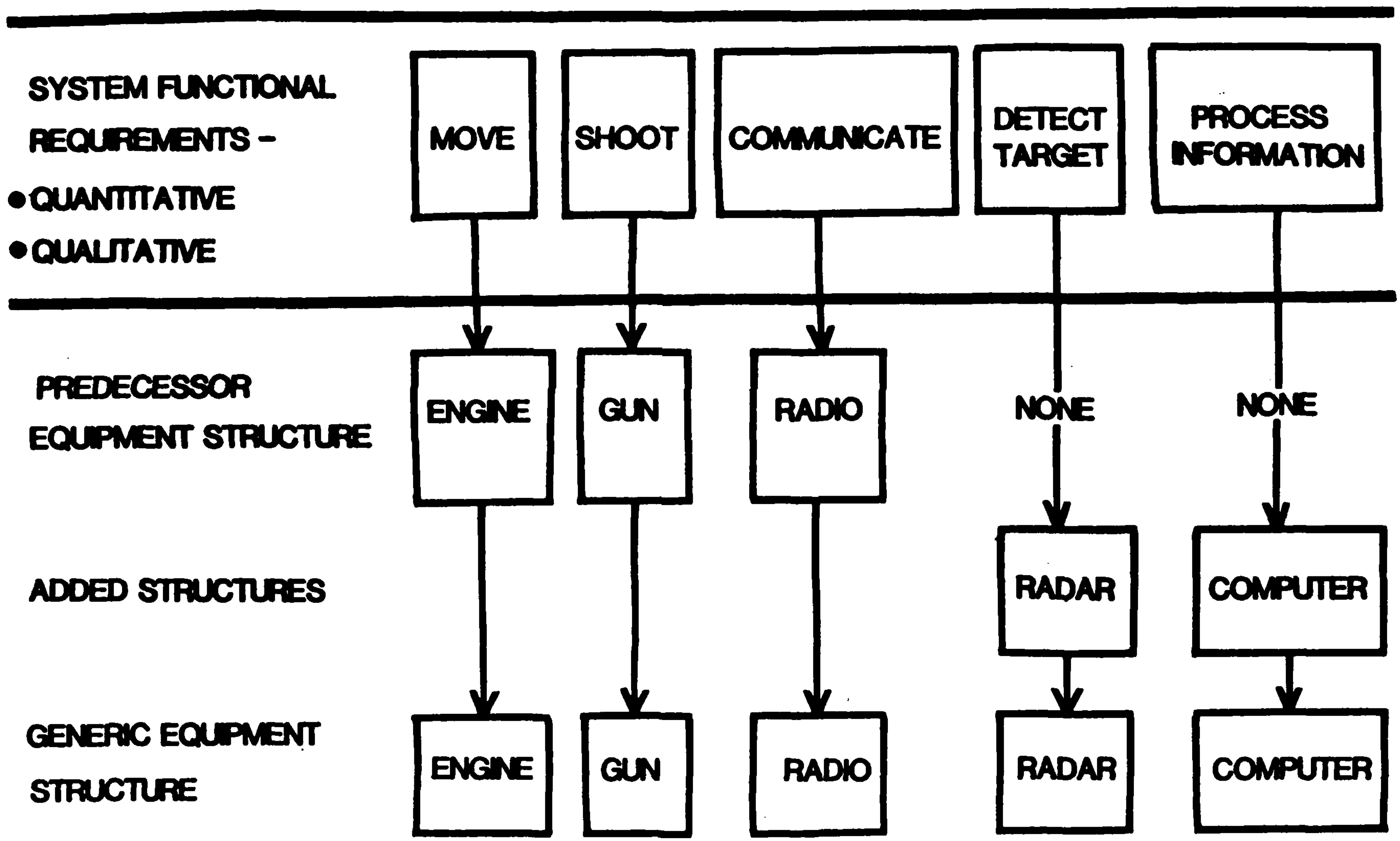
# HARDMAN METHODOLOGY



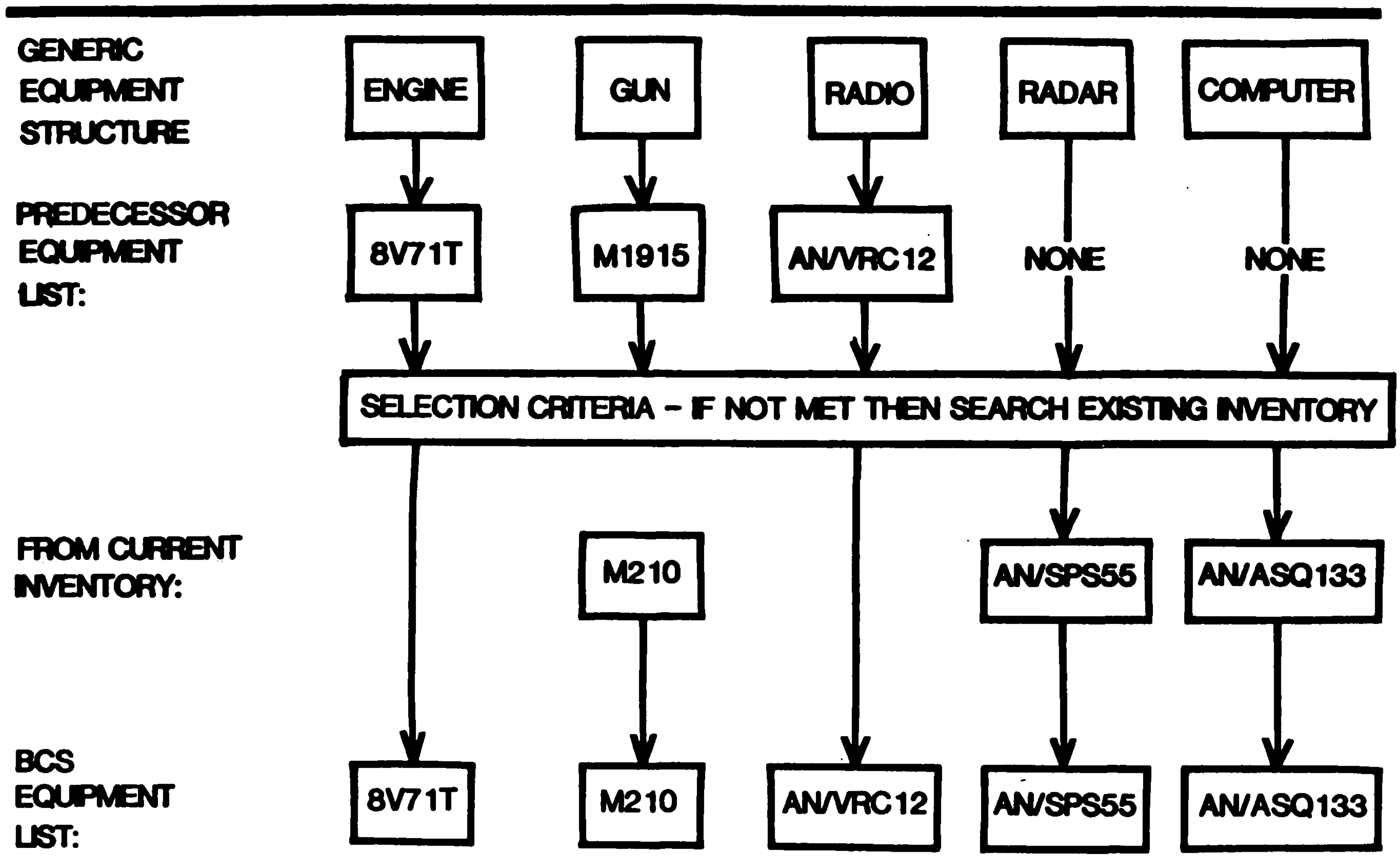
# BCS SELECTION CRITERIA

| SYSTEM DEFINITIONS | ADDRESSES MATERIEL PROGRAM'S FUNCTIONAL REQUIRMENTS ? | TECHNOLOGY USED | STATUS | WORKLOAD DATA |
|---|---|---|---|---|
| PRE DECESSOR | SOME, BUT HAS MANY DEFICIENCIES | EXISTING–OUTDATED/ OBSOLETE | DEPLOYED/ OBSOLETE DOD/NATO | MATURE |
| BASELINE COMPARISON SYSTEM(S) (BCS) | ALL, BUT HAS SOME DEFICIENCIES | CURRENT–STATE OF THE ART | DEPLOYED DOD/NATO | MATURE |
| PROPOSED SYSTEM | ALL, HAVE FEW DEFICIENCIES | FUTURE–EMERGING, LOW-RISK | IN DEVELOPMENT | IMMATURE ENGINEERING ESTIMATES OT/DT TEST LAB TEST |

# GENERIC EQUIPMENT STRUCTURE



# SELECT BCS COMPONENTS



# HARDMAN PRODUCTS

- TOTAL MANPOWER REQUIREMENTS(BY MOS AND SKILL LEVEL)
- PROJECTED SUSTAINMENT REQUIREMENTS
- PERSONNEL CONSIDERATIONS THAT REQUIRE CLOSE EVALUATION AND FUTURE MONITORING
- PROJECTED TRAINING INCREASES(BY MOS)
- ANNUAL INSTRUCTOR REQUIREMENTS
- PROJECTED ANNUAL TRAINING COSTS
- INITIAL LOGISTICS SUPPORT ANALYSIS DATA
- IDENTIFICATION OF AREAS FOR POSSIBLE SYSTEM DESIGN CHANGES TO INCREASE PERSONNEL SUPPORTABILITY

# HOW YOU CAN USE HARDMAN PRODUCTS

- SOURCE SELECTION & EVALUATION
- HUMAN RESOURCE – EQUIPMENT DESIGN TRADEOFFS
- UPDATES AND REASSESSES O&O PLAN
- INPUTS FOR TRAINING SUPPORT PLAN
- TENTATIVE QQPRI AND BOIP DEVELOPMENT
- INPUTS FOR COEA DEVELOPMENT
- INPUTS FOR ICTP AND IEP
- INPUTS FOR A ROAD MAP FOR ADDRESSING HMPT IN THE ACQUISITION PROCESS

# BENEFITS OF USING THE HARDMAN METHODOLOGY

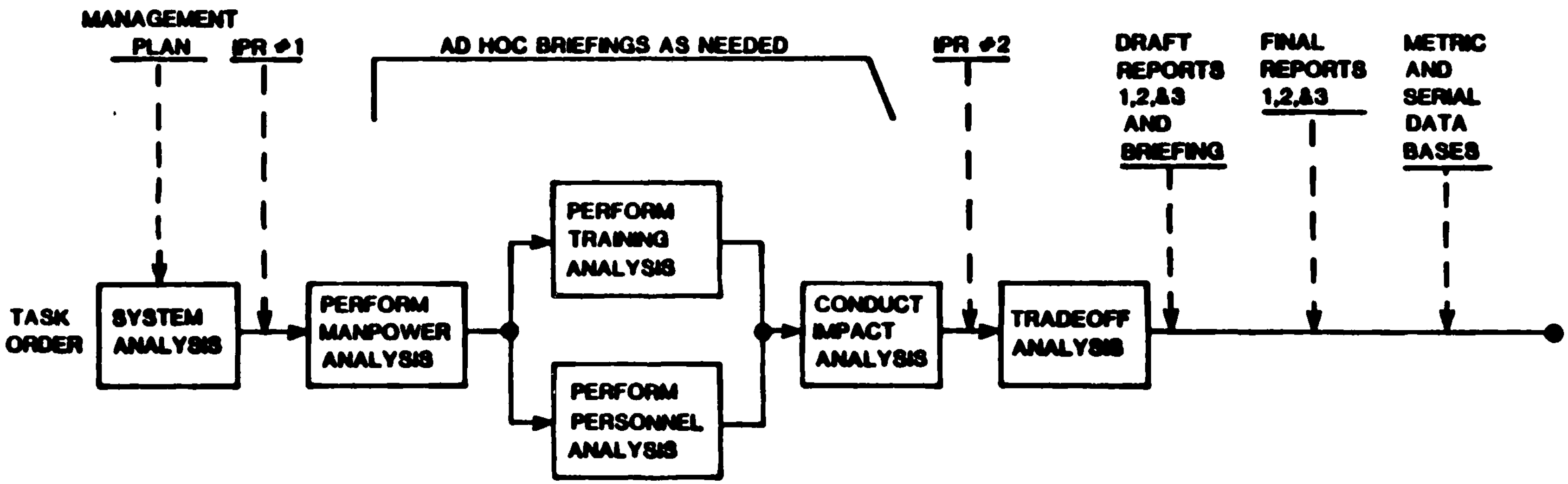
- PROVIDES EARLY ESTIMATES OF MPT REQUIREMENTS
- PROVIDES VISIBILITY TO HIGH DRIVERS
- PROVIDES A TRADEOFF ANALYSIS CAPABILITY
- PROVIDES A FULLY DOCUMENTED AUDIT TRAIL
- PROVIDES DATA ELEMENTS FOR REQUIRED PROGRAM REPORTS
- SUPPORTS DETAILED LEVEL ANALYSIS LATER IN THE MATERIEL ACQUISITION PROCESS
- INTEGRATES ADVANCED ANALYSIS TECHNIQUES AND CURRENT APPROVED DATA ANALYTIC TOOLS

# IPR MEMBERS – EACH APPLICATION

- TRADOC
  - TRADOC SYSTEM MANAGER REPRESENTATIVE *
  - COMBAT DEVELOPER OR OTHER USER REPRESENTATIVE (SSG/STF)
  - PROPONENT TRAINING DEVELOPER
  - LOGISTICS ORIENTED SCHOOL REPRESENTATIVE
- AMC
  - PROGRAM MANAGER/MATERIEL DEVELOPER REPRESENTATIVE
  - PROGRAM MANAGER FOR TRAINING DEVICES (WHERE NEEDED).
- OTHERS AS NEEDED

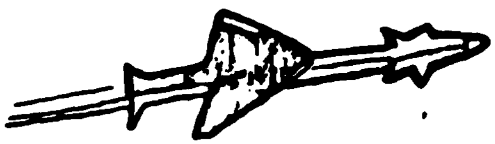
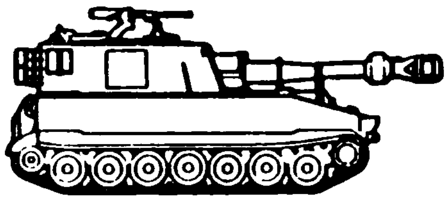
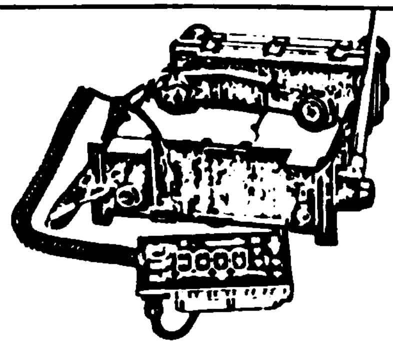
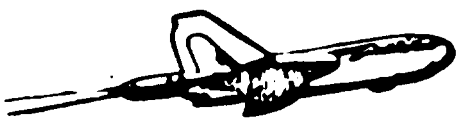
* IF A TSM HAS BEEN DESIGNATED.

## SPECIFIC FEATURES OF HARDMAN APPLICATION




- MONTHLY PROGRESS REPORTS
- AUDIT REPORTS ( IF NEEDED )

# ARMY HARDMAN APPLICATIONS TO DATE

| | EQUIPMENT SYSTEM | ACQUISITION PHASE | ANALYSIS SPONSOR/USER |
|---|---|---|---|
|  | CORPS SUPPORT WEAPON SYSTEM (CSWS) | MAA | CSWS SPECIAL TASK FORCE |
|  | DIVISION SUPPORT WEAPON SYSTEM (DSWS) | CONCEPT EXPLORATION | SPECIAL STUDY GROUP (SSG) (PM & TSM CANNON) |
|  | SINGLE CHANNEL GROUND/AIRBORNE RADIO SYSTEM (SINCGARS) | D & V | ILS MANAGER & TSM SINCGARS |
|  | REMOTELY PILOTED VEHICLE (RPV) | FSED | PM RPV |

# JPL FINDINGS

- CREDIBLE
  - MEETS MAJORITY OF USER MPT REQUIREMENTS
  - MOST COMPREHENSIVE METHODOLOGY AVAILABLE
  - INTEGRATES MPT ISSUES
  - SOUND ENGINEERING PRINCIPLES – LOGICAL
  - SIMILAR TO KNOWN, ACCEPTED MPT MODELING PROCEDURES
- GENERALLY RELIABLE, ( OTHERS CAN REPLICATE PROCEDURES )
- APPROACH IS FLEXIBLE ( DATA MANAGEMENT / APPLICATION TO SYSTEM )
- ROOM FOR GROWTH – – IMPROVEMENTS UNDERWAY

# HARDMAN APPLICATIONS AND RESULTS

| SYSTEM | DEVELOPMENT PHASE | APPLICATION SCOPE | IMPACT | FOLLOW-UP ACTION |
|---|---|---|---|---|
| CSWS | MAA | EXAMINED MPT IMPACT OF POSSIBLE CONFIG-URATIONS | FLAGGED CONFIG-URATION LOWEST IN MPT DEMAND | NONE AT PRESENT |
| DSWS (NOW HIP) | CE | COMPARED CON-TRACTOR & REFERENCE SYSTEM MPT ESTIMATES | FLAGGED 35 E MOS AS A KEY PERSON-NEL RISK | SYSTEM REQUIRE-MENTS HAVE BEEN REVISED; MPT RAM-IFICATIONS ARE BEING EXAMINED |
| SINCGARS | D&V | COMPARED CON-TRACTOR & REFERENCE SYSTEM MPT ESTIMATES | LARGE DISCREPAN-CIES BETWEEN CON-TRACTOR & REFERENCE SYSTEM RAM ESTIMATES | PREPARING TO EXAMINE RAM RISK THROUGH SAMPLE DATA COLLECTION |
| RPV | FSD | COMPARED CONTRACTORS & REFERENCE SYSTEM MPT ESTIMATES | VERIFIED THAT CONTRACTOR ESTI-MATES WERE REASONABLE | NONE AT PRESENT |

# FLAGGING A MANPOWER RISK: EXAMPLE OUTPUT FROM DSWS

## MANPOWER: DIVISION LEVEL SUMMARY

| DIRECT SUPPORT MOS | BCS | | PROPOSED SYSTEMS PIP | NEW DESIGN A | NEW DESIGN B |
|---|---|---|---|---|---|
| 31S | 2 | | 1 | 1 | 2 |
| 34Y | 1 | | 1 | 1 | 1 |
| 35E | $\boxed{83}$ | 35E $\Delta$? MANPOWER RISK | 5 | 1 | 1 |
| 35H | 2 | | 2 | 2 | 2 |
| 41C | 1 | | 1 | 1 | 1 |

35E HAS A HIGH EL APTITUDE REQUIREMENT AND A HIGH ATTRITION RATE; IT WILL BE DIFFICULT AND EXPENSIVE TO ACQUIRE AND KEEP LARGE NUMBERS OF THESE PEOPLE.

# AUDIT TRAIL ON 35 E (SPECIAL ELECTRONICS DEVICES REPAIRER) REVEALS THAT THE PROBLEM LIES IN RAM DISCREPANCIES FOR DSWS NAVIGATION SYSTEMS

(BCS VS. PROPOSED)

| | BCS | PROPOSED SYSTEM | | |
|---|---|---|---|---|
| | | PIP | NEW DESIGN A | NEW DESIGN B |
| SPECIFIC NAVIGATION SYSTEM | AGPS | AHRS | KHS-2100 | PADS |
| DATA SOURCE | CONTRACTOR DT | CONTRACTOR ESTIMATE | CONTRACTOR ESTIMATE | CONTRACTOR ESTIMATE |
| RELIABILITY (R) | 60.42 ACTIONS/ 1000 HR. | 4.35 ACTIONS/ 1000 HR. | .36 ACTIONS/ 1000 HR. | 1.125 ACTIONS/ 1000 HR. |
| MAINTAINABILITY (M) | 8.00 MH/ ACTION | 1.60 MH/ ACTION | 1.09 MH/ ACTION | 2.70 MH/ ACTION |

# POTENTIAL SOLUTIONS TO 35E PROBLEM

**BY NOTING THIS PROBLEM EARLY THE ARMY COULD CONSIDER SEVERAL OPTIONS FOR SOLVING THE PROBLEM:**

- CONSIDER DROPPING THE NAVIGATION SYSTEM AS A REQUIREMENT
- FOCUS MANAGEMENT ATTENTION AND RESOURCES ON THE NAVIGATION SYSTEM TO BE SURE THAT CONTRACTORS DELIVER THE PROMISED RAM
- SEND AN EARLY ALERT TO THE PERSONNEL & TRAINING COMMUNITIES SO THEY CAN EVALUATE OPTIONS

# IMPLEMENTATION ACTIONS

- DEVELOP ARMY PROCEDURAL GUIDE
- SSC-NCR CONTRACT FOR HARDMAN ANALYSES FY84-FY86
- HARDMAN FAMILIARIZATION BRIEFINGS
- HARDMAN BRIEFINGS-INTEGRATING CENTERS

    LOGCEN-EQUIPPING THE FORCE COURSE

    CAC-DEVELOPING THE FORCE COURSE

    SSC-MANNING THE FORCE COURSE

# ARMY HARDMAN GUIDEBOOK DEVELOPMENT

PURPOSE:

- OBTAIN DETAILED SPECIFICATIONS OF PROCESS.
- STANDARDIZE PROCESS AND OUTPUTS.
- SECURE TECHNOLOGICAL TRANSFER.
- INCORPORATE RECOMMENDED IMPROVEMENTS FROM JPL EVALUATION.

# ARMY HARDMAN GUIDEBOOK DEVELOPMENT

- DEVELOPER
  - DYNAMICS RESEARCH CORPORATION
- REVIEWERS
  - SSC-NCR (TRADOC)
  - ARMY RESEARCH INSTITUTE (DCSPER)
  - MATERIEL READINESS SUPPORT ACTIVITY (AMC)
- INFO/COMMENTS
  - TRADOC SYSTEM ANALYSIS ACTIVITY
  - US ARMY LOGISTICAL CENTER (TRADOC)
  - ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY (AMC)

# SSC-NCR HARDMAN CONTRACT

- FIVE APPLICATIONS STARTED DURING FY 84.
- FIVE APPLICATIONS STARTED DURING FY 85.
- AN OPTIONAL FIVE APPLICATIONS TO START FY 86.
- FIVE WEEKS OF TRAINING IN HARDMAN METHODOLOGY FOR SEVEN TRAINEES.

# CURRENT HARDMAN APPLICATIONS

(FY 84 STARTS)

- LIGHT HELICOPTER FAMILY (LHX)
- ALL SOURCE ANALYSIS SYSTEM (ASAS)
- SHORT RANGE AIR DEFENSE COMMAND AND CONTROL (SHORAD $C^2$)
- HAWK PHASE II: PIP
- SGT YORK

# CURRENT HARDMAN APPLICATIONS

## ( FY 85 STARTS )

- DIRECTED ENERGY WEAPON (STINGRAY)
- ARMORED GUN SYSTEM (AGS/XM4)
- ELEVATED TARGET ACQUISITION SYSTEM (ETAS)
- PATRIOT
- LIGHTWEIGHT AIR DEFENSE SYSTEM (LADS)

# FUTURE HARDMAN APPLICATIONS
## ( FY 86 STARTS )

- ADVANCED FA TACTICAL DATA SYSTEM (AFATDS)
- LONG RANGE ANTITANK SYSTEM (LRAT)
- FUTURE ARMOR COMBAT SYSTEM (FACS)
- AIR DEFENSE ELECTRONIC WARFARE SYSTEM (ADEWS)
- FORWARD AREA ARMORED LOGISTICS SYSTEM (FAALS)

# INTRODUCTION

- WHO WILL BENEFIT FROM THE USE OF HARDMAN?
- WHAT IS HARDMAN AND WHAT ARE THE ESSENTIAL FEATURES AND RELATIONSHIPS OF HARDMAN TO MY CURRENT DUTIES?
- WHY MUST I BE GIVEN TRAINING ON THE HARDMAN METHODOLOGY?
- WHEN WILL I BE INVOLVED IN MANAGEMENT, APPLICATION, OR IMPLEMENTATION OF THE RESULTS OF THE HARDMAN METHODOLOGY?
- CAN YOU PROVIDE ME CONCRETE EXAMPLES OF THE USE OF HARDMAN?
- IS THERE ANY OTHER INFORMATION AVAILABLE ON HARDMAN, BESIDES THIS FAMILIARIZATION COURSE?
- TELL ME A LITTLE OF THE EVOLUTION OF HARDMAN.
- WILL THIS FAMILIARIZATION COURSE PROVIDE ME WITH ENOUGH GENERAL KNOWLEDGE OF HARDMAN TO PERFORM MY DUTIES?

# WHAT IS HARDMAN?

- METHODOLOGY FOR:

  ESTIMATING MANPOWER, PERSONNEL, AND TRAINING (MPT)

  ADDRESSING HIGH DRIVERS OF MPT REQUIREMENTS

  IDENTIFICATION OF TRADEOFFS BASED ON MPT REQUIREMENTS

- USES:

  COMPARABILITY ANALYSIS TECHNIQUES

  MATURE/EMPIRICAL SYSTEM DATA

  A CONSOLIDATED DATA BASE

- PROVIDES:

  CLEAR DEFINITIONS OF INPUTS AND OUTPUTS

  DETAILED AUDIT TRAIL

  ITERATIVE PROCESSES FOR REVISION OF MPT BASED ON MATERIEL CHANGES

# HARDMAN OBJECTIVES

ASSISTS MATERIEL ACQUISITION COMMUNITY TO:

- MEET MANPRINT OBJECTIVES FOR THE SYSTEM
- CONTRIBUTE TO SYSTEM ACQUISITION FRONT–END ANALYSIS
- DEVELOP AND HIGHLIGHT MPT FACTORS IN SYSTEM DESIGN
- REDUCE OPERATIONAL COSTS
- REDUCE SUPPORTABILITY COSTS
- DEVELOP INTEGRATED LOGISTICS SUPPORT REQUIREMENTS
- DEVELOP INTEGRATED SYSTEM SUPPORT REQUIREMENTS
- FIELD SYSTEMS WHICH OPTIMIZE MPT ISSUES

# EVOLUTION OF HARDMAN

| | | |
|---|---|---|
| USAF | COORDINATED HUMAN RESOURCE TECHNOLOGY | (1977 - 1980) |
| USN | HARDWARE VS. MANPOWER | (1978 - 1981) |
| USA | ARMY HARDMAN | (1980 - ) |

- ARI DEVELOPED AND DEMONSTRATED
- JPL VALIDATED
- SSC SUPPORTED AND SPONSORED

# WHO WILL BENEFIT FROM HARDMAN?

- SOLDIER
- LEADER
- MATERIEL DEVELOPER
- COMBAT DEVELOPER
- PROGRAM/PROJECT MANAGER
- TRADOC SYSTEM MANAGER
- TRAINING DEVELOPER
- RESOURCE MANAGER
- TRAINER
- PERSONNEL MANAGER
- ILS MANAGER

# USES OF THE METHODOLOGY

SATISFIES DEMANDS OF THE MATERIEL ACQUISITION PROCESS BY:

- PLANNING FOR OPERATIONAL AND SUPPORTABILITY ISSUES
- COMPARING ACQUISITION ALTERNATIVE REQUIREMENTS
- PREPARING:
  - MATERIEL REQUIREMENTS DOCUMENTS
  - PLANNING DOCUMENTS AND PROCEDURES
  - FOR MILESTONE REVIEWS
- COORDINATING:
  - MATERIEL ISSUES WITH MANPRINT ISSUES
  - FORCE MODERNIZATION REQUIREMENTS
  - BRANCH PROPONENCY REQUIREMENTS

# HARDMAN AND THE LIFE CYCLE SYSTEM MANAGEMENT MODEL (LCSMM)

## PHASES

MISSION AREA ANALYSIS *

CONCEPT EXPLORATION

DEMONSTRATION AND VALIDATION

FULL SCALE DEVELOPMENT

PRODUCTION AND DEPLOYMENT

SUSTAINMENT **

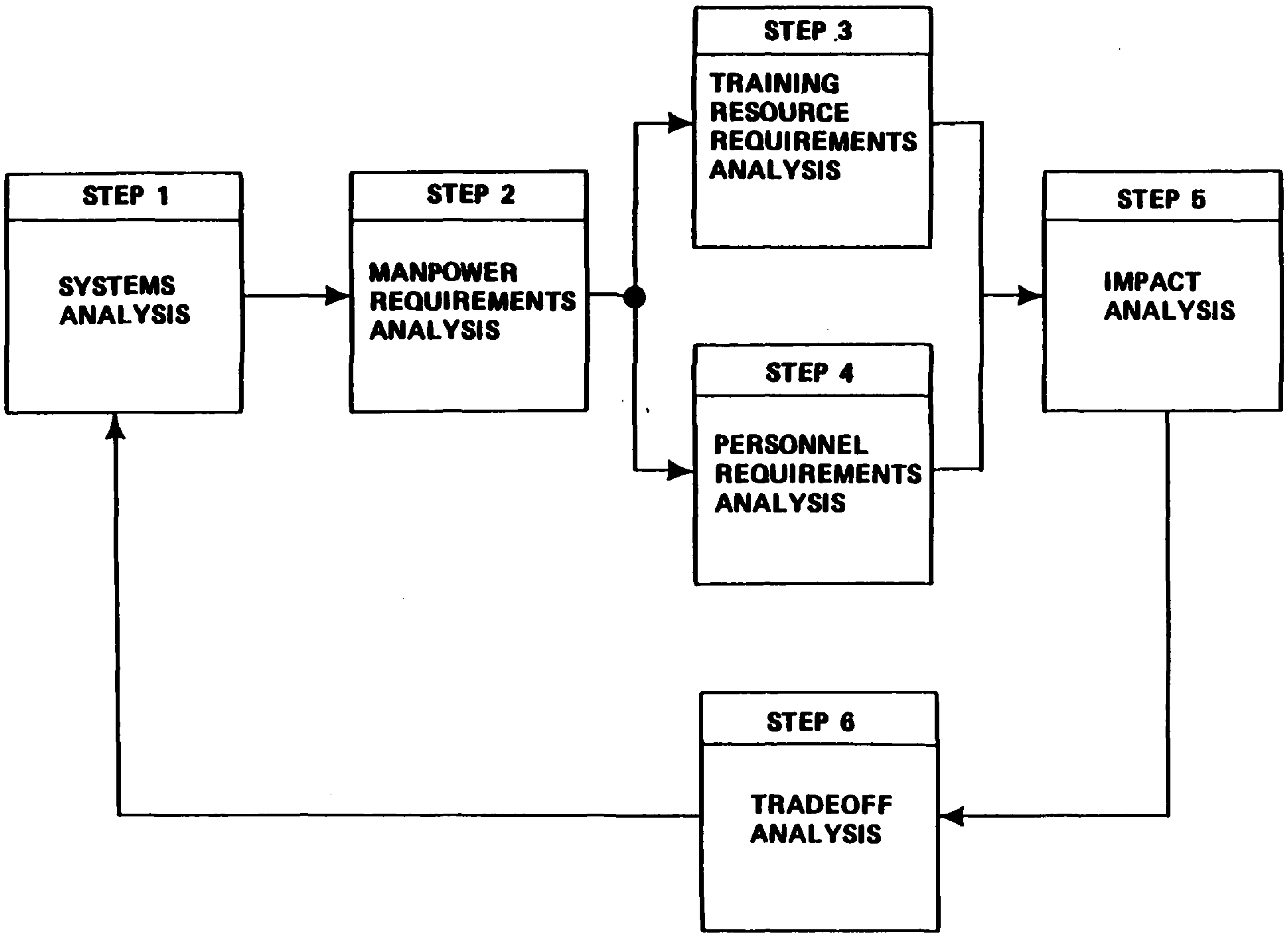
* Not an actual phase of LCSM Model, but a direct driver of the LCSM Model (Doctrine, Organization, Training and Materiel)

** Not an actual phase of LCSM Model but sustainment and supportability issues are key focus after Production and Deployment

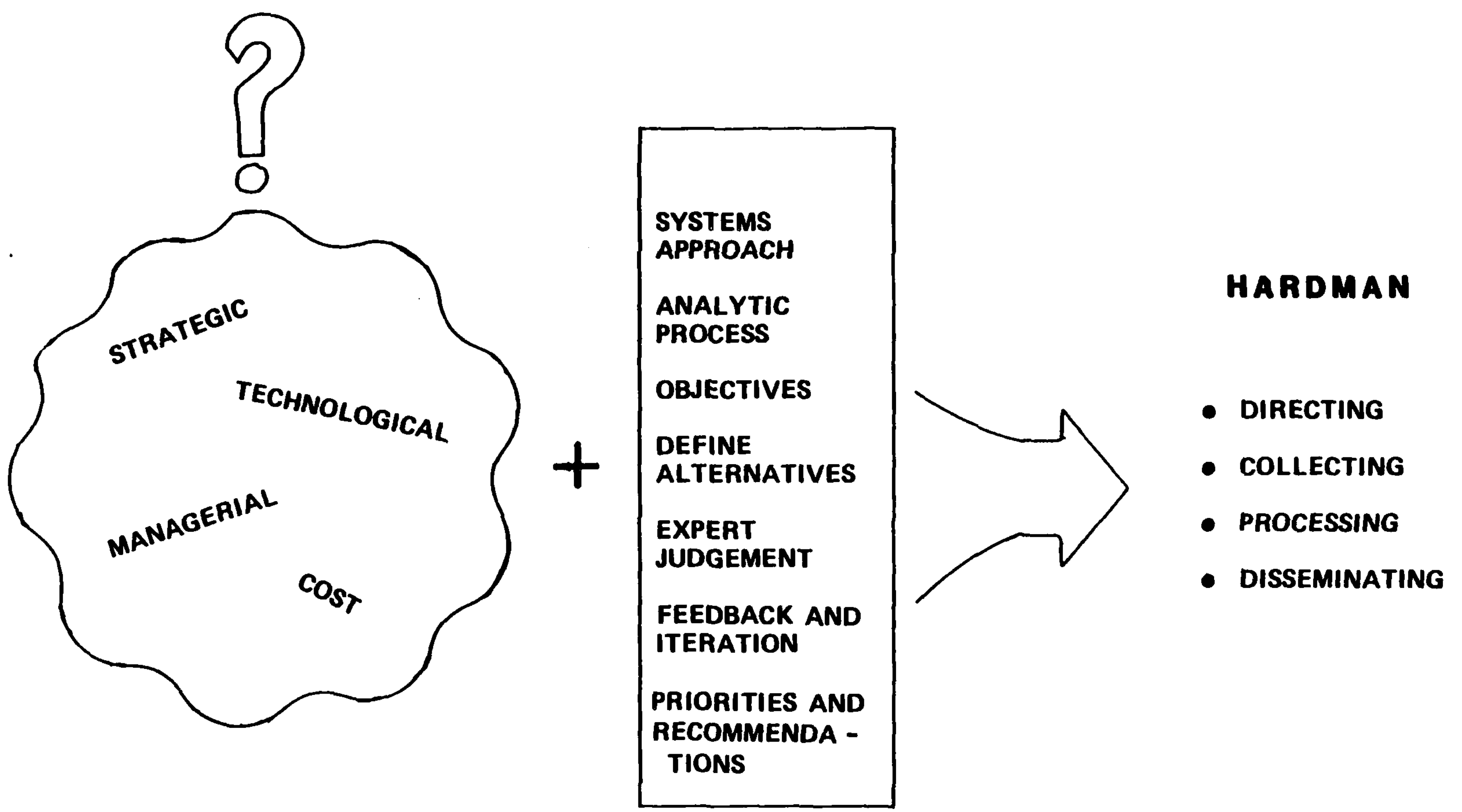
# HOW WILL HARDMAN HELP THE ARMY?

- EARLY IDENTIFICATION OF POSSIBLE MPT ISSUES
- USE OF A DISCIPLINED AND ANALYTIC APPROACH TO MPT ISSUES
- *IDENTIFICATION OF DOCUMENTATION APPLICABLE TO* MPT ISSUES
- INFLUENCING ENGINEERING DESIGN ISSUES WITH MPT

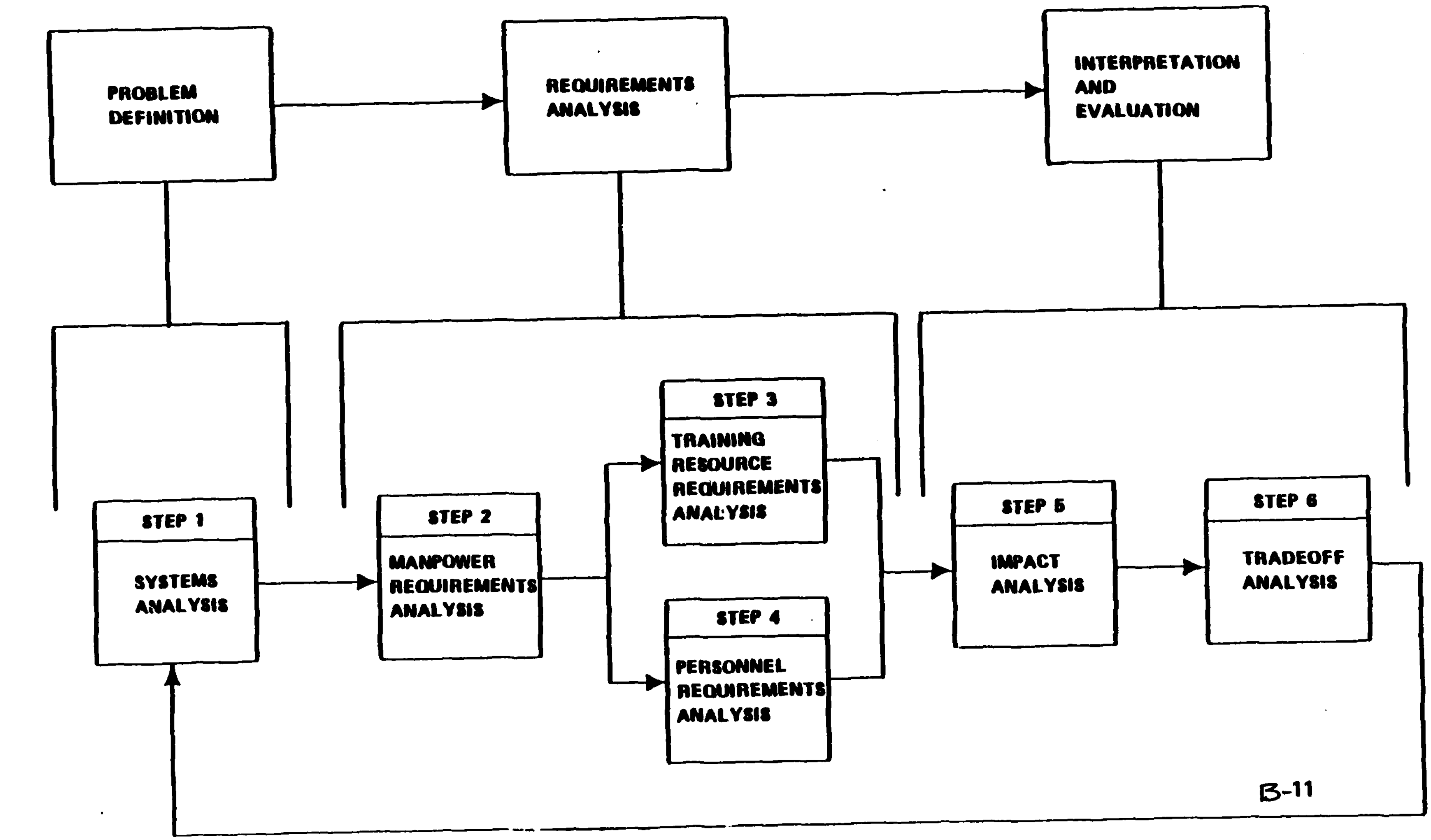
# STEPS IN THE METHODOLOGY



# UNCERTAINTY AND RISK



# STEPS VS. HIGHER LEVEL PROCESSES



# HARDMAN SUB-ANALYSIS

| STEP 1 | STEP 2 | STEP 3 | STEP 4 | STEP 5 | STEP 6 |
|---|---|---|---|---|---|
| SYSTEM ANALYSIS | MANPOWER ANALYSIS | TRAINING RESOURCE REQUIREMENTS ANALYSIS | PERSONNEL ANALYSIS | IMPACT ANALYSIS | TRADEOFF ANALYSIS |
| • Mission Analysis | • MOS/Grade Determination | • Task Comparability Analysis | • Personnel Requirements Analysis | • Impact Analysis | • Tradeoff Analysis |
| • Functional Requirements Analysis | • Workload Analysis | • Course Requirements Analysis | | | |
| • Equipment Comparability Analysis | • Manpower Requirements Determination | • Training Cost and Resource Determinations | | | |
| • Reliability and Maintainability Analysis | | | | | |
| • Task Identification | | | | | |

# MIL-STD-1388-1A: COMPARATIVE ANALYSIS

SELECT OR DEVELOP A BASELINE COMPARISON SYSTEM (BCS) REPRESENTING CHARACTERISTICS OF THE NEW SYSTEM/EQUIPMENT FOR

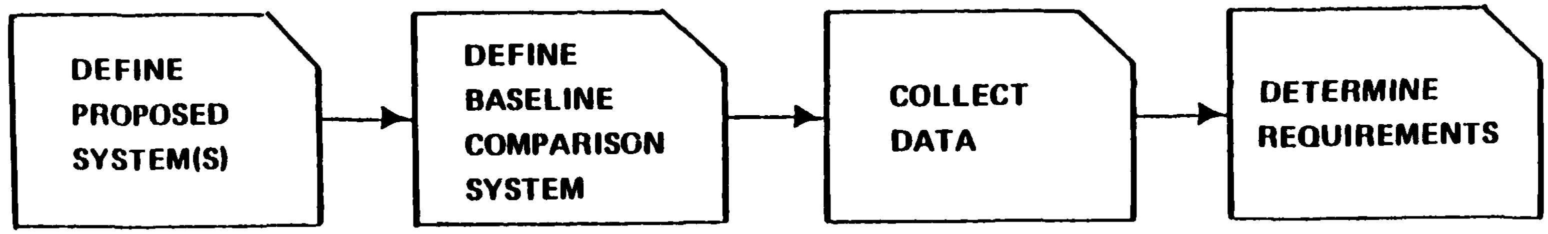
(1) PROJECTING SUPPORTABILITY RELATED PARAMETERS, MAKING JUDGMENTS CONCERNING THE FEASIBILITY OF THE NEW SYSTEM/EQUIPMENT SUPPORTABILITY PARAMETERS, AND IDENTIFYING TARGETS FOR IMPROVEMENT, AND

(2) DETERMINING THE SUPPORTABILITY, COST, AND READINESS DRIVERS OF THE NEW SYSTEM/EQUIPMENT.

# HARDMAN SYSTEM DEFINITIONS

| SYSTEM TYPE | SATISFIES NEW SYSTEM FUNCTIONAL REQUIREMENTS? WHAT | HOW WELL | TECHNOLOGY | STATUS | DATA |
|---|---|---|---|---|---|
| PREDECESSOR | MAJORITY | MANY DEFICIENCIES | EXISTING– OUTDATED/ OBSOLETE | DEPLOYED/OBSOLETE DoD/NATO | MATURE |
| BCS | ALL | SOME DEFICIENCIES | CURRENT– STATE-OF-THE-ART | DEPLOYED– DoD/NATO | MATURE |
| PROPOSED | ALL | FEW DEFICIENCIES | FUTURE– EMERGING, NOT DEMONSTRATED | IN DEVELOPMENT | IMMATURE<br>• ENGINEERING ESTIMATES<br>• OT/DT TEST<br>• LAB TEST |

# COMPARABILITY ANALYSIS
# THE BASIC APPROACH



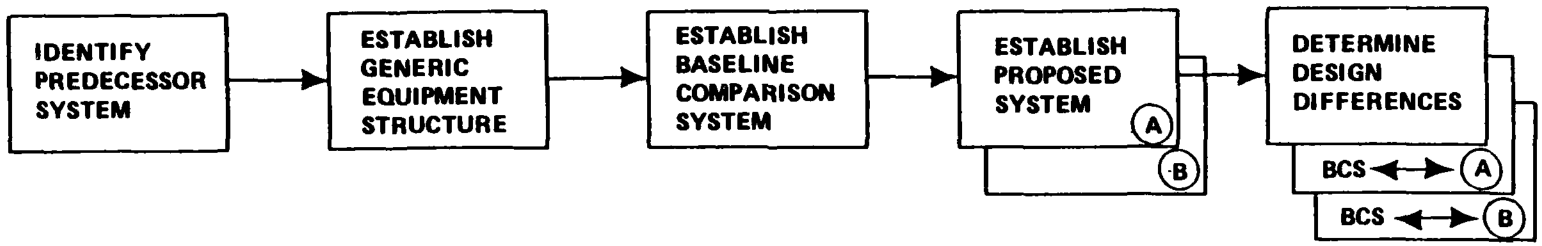

- MISSION AREA ANALYSIS
- TECHNOLOGY BASE STUDIES
- REQUIREMENTS DOCUMENTS
- CONTRACTOR STUDIES/PROPOSALS

- MISSION AREA ANALYSIS
- DOD/NATO INVENTORY

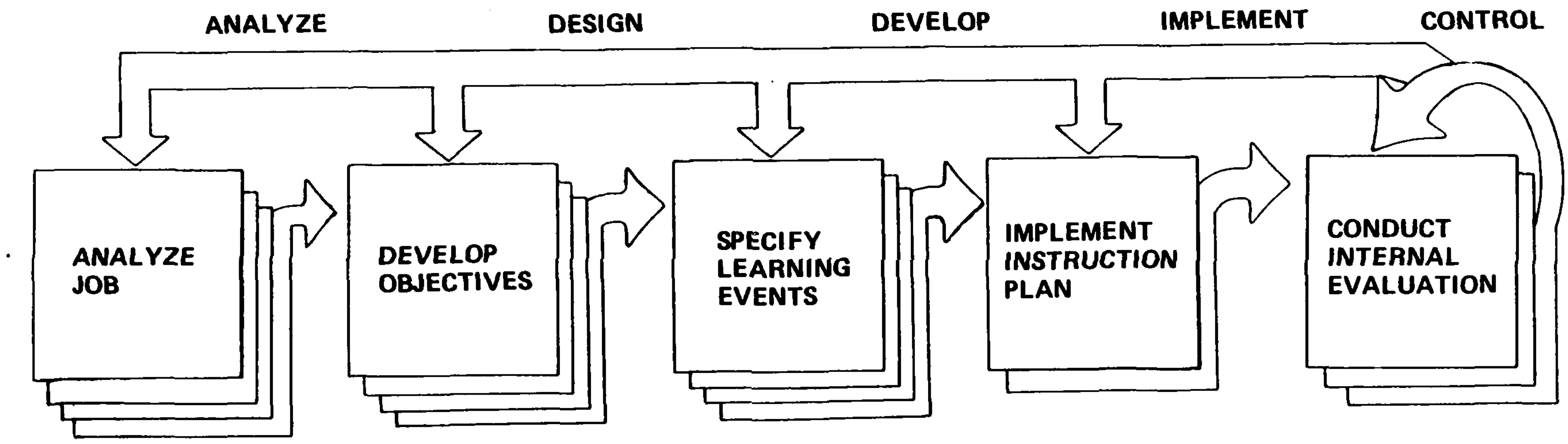
- HISTORICAL MAINTENANCE DATA
  - NAVY: 3M
  - AF: 66–1
  - ARMY: SDC
- OPERATOR/CREW

- PROPOSED SYSTEM REQ= f (Δ, BCS DATA)

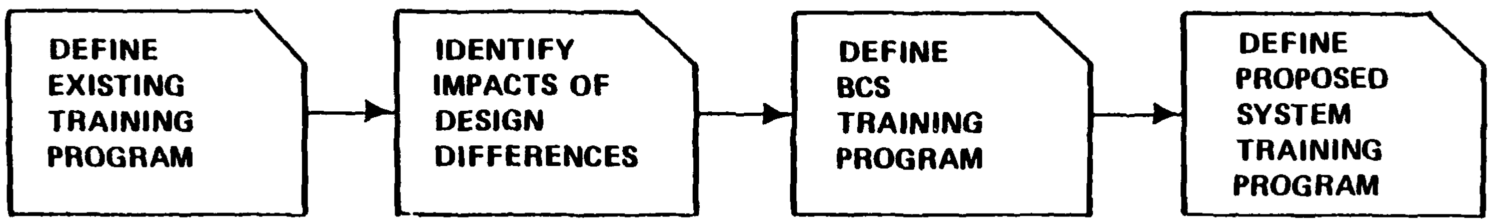
# EQUIPMENT COMPARABILITY ANALYSIS



# INSTRUCTIONAL SYSTEMS DEVELOPMENT



# TRAINING COMPARABILITY ANALYSIS




**DEFINE EXISTING TRAINING PROGRAM**

- *AR 611-201*
- SOLDIERS/ COMMANDERS MANUALS
- TRAINER'S GUIDES
- PROGRAMS OF INSTRUCTION (POI)
- ATRM--159 TRAINING COST DATA

**IDENTIFY IMPACTS OF DESIGN DIFFERENCES**

- Δ *TASKS*
- Δ COURSES
- Δ RESOURCES
- Δ COSTS

**DEFINE BCS TRAINING PROGRAM**

- *REFLECTS DESIGN* DIFFERENCES BE- TWEEN BCS AND EXISTING SYSTEM
- QUASI – POI
  - TASKS
  - COURSES
  - RESOURCES
  - COSTS

**DEFINE PROPOSED SYSTEM TRAINING PROGRAM**

- *REFLECTS DESIGN* DIFFERENCES BE– TWEEN PROPOSED SYSTEM AND BCS
- QUASI – POI
  - TASKS
  - COURSES
  - RESOURCES
  - COSTS

# PURPOSES OF CDB

- SUPPORT HARDMAN REQUIREMENTS ANALYSIS
- FACILITATE TRADEOFFS
- PROVIDE INFORMATION FOR REQUIRED PROGRAM REPORTS
- JUSTIFY DECISION MAKING VIA AUDIT TRAILS

# CDB INPUTS

GENERIC REQUIREMENTS

- DoD PUBLICATIONS/SOURCES
- DA PUBLICATIONS/SOURCES
- AMC PUBLICATIONS/SOURCES
- TRADOC PUBLICATIONS/SOURCES
- FIELD COMMAND PUBLICATIONS/SOURCES
- GOVERNMENT/INDUSTRY TECHNOLOGY BASE

SYSTEM SPECIFIC REQUIREMENTS

- ACQUISITION STRATEGY DOCUMENTATION
- PLANNING DOCUMENTATION
- PROGRAM MANAGEMENT DOCUMENTATION
- MATERIEL REQUIREMENTS DOCUMENTATION
- ILS DOCUMENTATION (RAM, TM, ETC.)
- MANPOWER DOCUMENTATION
- PERSONNEL DOCUMENTATION
- TRAINING DOCUMENTATION
- MATERIEL CONTRACTOR(S) STUDIES/PROPOSALS

ANALYSIS SPECIFIC REQUIREMENTS

- IMPACT ANALYSIS
- TRADEOFF ANALYSIS

# GOVERNMENT FURNISHED INFORMATION
# (PARTIAL LIST)

EXISTING SUPPORTING REQUIREMENTS DOCUMENTS, IN DRAFT OR IN FINAL FORM.

EXISTING MILESTONE REVIEW DOCUMENTATION, IN DRAFT OR IN FINAL FORM.

MISSION AREA ANALYSIS DOCUMENTATION TO INCLUDE THE O&O PLAN AND JMSNS, ETC.

OPERATIONAL REQUIREMENTS OF CD

MAINTENANCE POLICY AND MAINTENANCE SUPPORT CONCEPT

SUPPLY/EQUIPMENT LISTS

PERSONNEL POLICY, EXISTING SKILLS, AND TRAINING CAPABILITIES

ENVIRONMENTAL CONSIDERATIONS

EXISTING LSAR FOR APPLICABLE SYSTEMS (ITEMS) BY PHASE

LOW, MEDIUM AND HIGH INTENSITY SCENARIO DATA

# AUDIT TRAIL OF ANALYSIS

WHAT: ROADMAP ACROSS HARDMAN STEPS

WHY:

- FOLLOW ROADMAP BACKWARD TO UNCOVER SOURCE OF MPT IMPACTS AND VALIDATE RESULTS
- FOLLOW ROADMAP FORWARD TO DEVELOP ALTERNATIVES FOR TRADEOFFS
- CHANGES/UPDATES/MODIFICATIONS TO:
  - DATA SOURCES
  - DATA ELEMENTS
  - ANALYSIS METHODS
  - ANALYSIS RESULTS

# DATA MANAGEMENT STRUCTURE

- SYSTEMATIC, CONSISTENT METHOD OF ORDERING INFORMATION

- MOST CONVENIENTLY TIED TO HARDWARE SYSTEM COMPONENT BECAUSE HARDWARE IS ESTABLISHED FIRST IN HARDMAN

- MAY BE:

  - WORK BREAKDOWN STRUCTURE (WBS)
  - WORK UNIT CODE (WUC)
  - EQUIPMENT IDENTIFICATION CODE (EIC)
  - FUNCTIONAL GROUPING CODE (FGC)
  - LSA CONTROL NUMBER

  \+ MILITARY OCCUPATIONAL SPECIALTY CODE (MOSC)

  OR ANY SUBSET/COMBINATION OF ABOVE PROVIDED FIRST REQUIREMENT IS SATISFIED

  - HARDWARE/MATERIEL BREAKOUT BY SYSTEM
  - MPT BREAKOUT BY MOS

# CHARACTERISTICS OF CDB

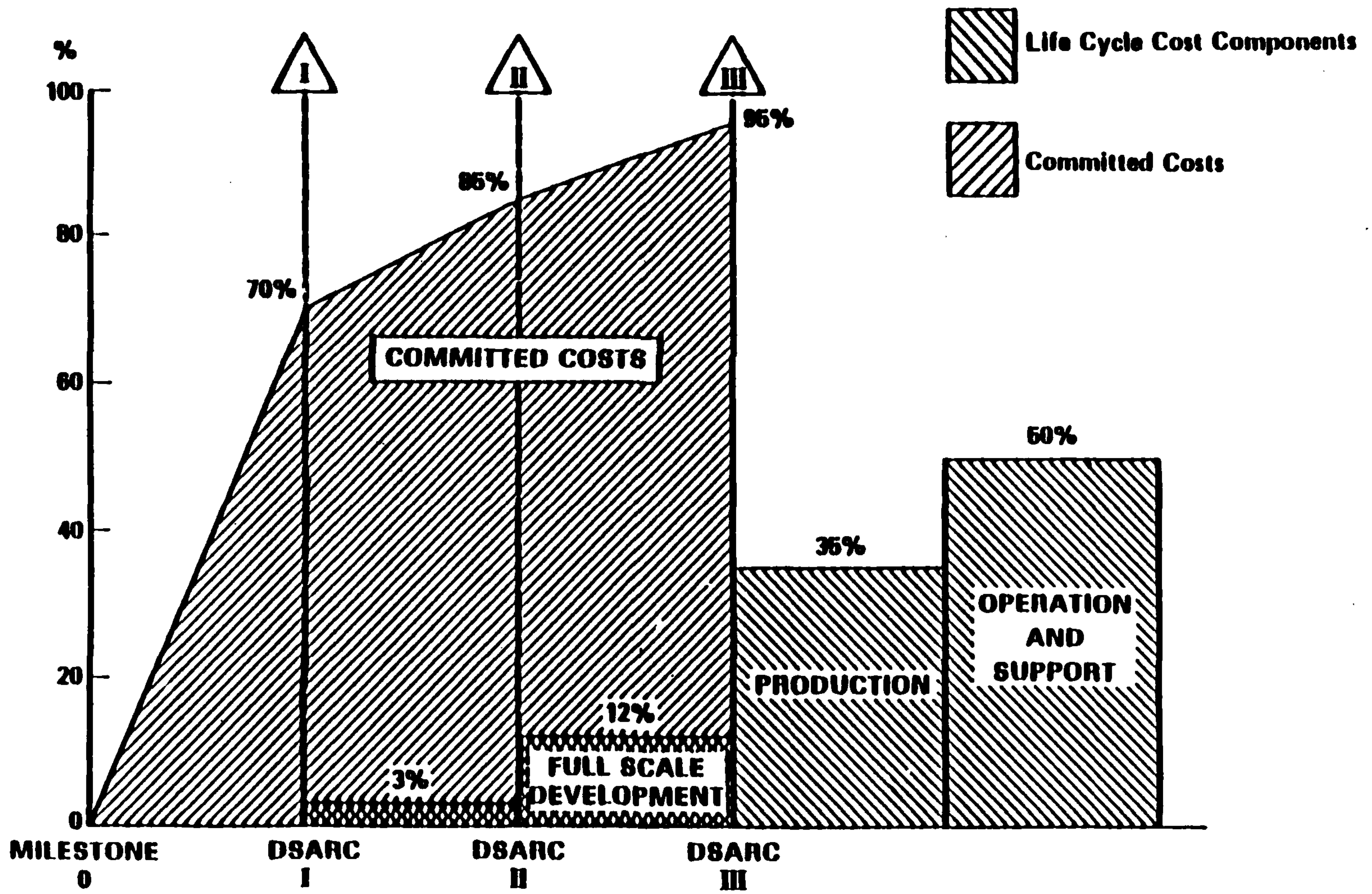
- SINGLE INTEGRATED DATA BASE TO SUPPORT MPT ANALYSES
  - EXPLICIT ASSUMPTIONS
  - CONSISTENT DEFINITIONS
  - COMMON DATA FORMATS/ELEMENTS
- COMMUNICATIONS LINK FOR DISPARATE DISCIPLINES
- TAILORED FOR INDIVIDUAL APPLICATIONS
- AUDIT TRAIL

# CDB ACHIEVES CONTINUITY

THE DATA COLLECTION PLAN PROVIDES CONTINUITY TO ALL THE ELEMENTS/INPUTS/SOURCES OF THE CDB:

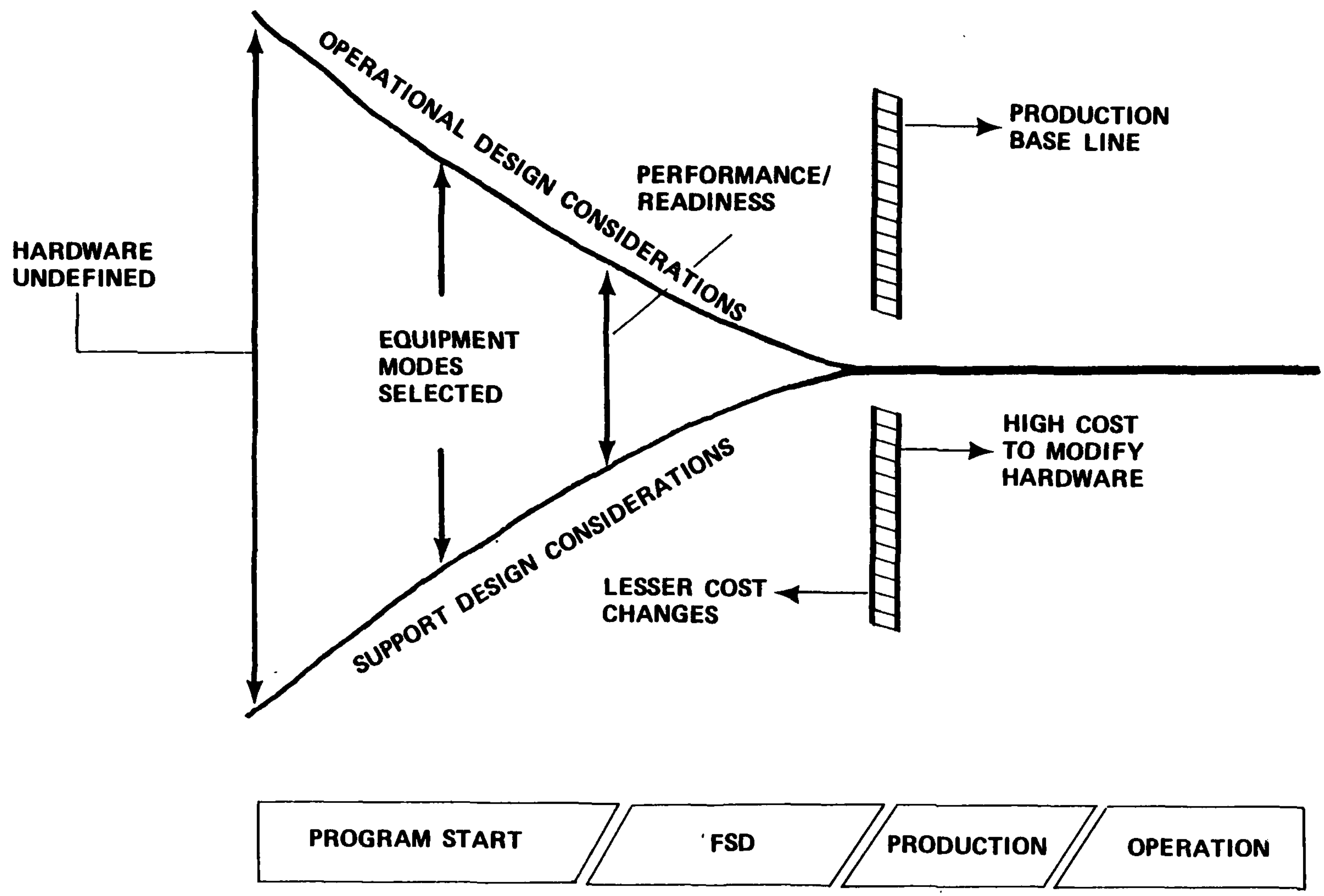
- AMONG PARTICIPANTS
- WITHIN THE ANALYSIS
- AS A HISTORICAL DOCUMENT
- AS AN ANALYTICAL TOOL
- AS AN ACTIVE DATA BASE

# TYPICAL DEFENSE SYSTEM COST




SOURCE: Assistant Secretary of Defense (Comptroller)

# DECREASING UNCERTAINTY OVER TIME IN LCSMM



# HARDMAN PRODUCTS

- QUANTIFIED MANPOWER REQUIREMENTS (BY MOS & SKILL LEVEL)
- QUANTIFIED SUSTAINMENT REQUIREMENTS – PERSONNEL
- PERSONNEL CONSIDERATIONS THAT REQUIRE CLOSE EVALUATION AND FUTURE MONITORING
- PROJECTED TRAINING INCREASES (BY MOS)
- ANNUAL INSTRUCTOR REQUIREMENTS
- PROJECTED ANNUAL TRAINING COSTS
- INITIAL LOGISTICS SUPPORT ANALYSIS DATA
- IDENTIFICATION OF AREAS FOR POSSIBLE SYSTEM DEVELOPMENT CHANGES TO INCREASE PERSONNEL SUPPORTABILITY
- SYSTEM SPECIFIC DATA BASE

# HOW HARDMAN PRODUCTS SHOULD BE USED

- SOURCE SELECTION AND EVALUATION
- HUMAN RESOURCE – EQUIPMENT DESIGN TRADEOFFS
- UPDATES AND REASSESSMENTS OF O&O PLAN
- INPUTS FOR TRAINING SUPPORT PLAN
- TENTATIVE QQPRI AND BOIP DEVELOPMENT
- INPUTS FOR COEA DEVELOPMENT
- INPUTS FOR ICTP AND IKP
- INPUTS FOR ASARCS

# METHODOLOGY OVERVIEW

| | | |
|---|---|---|
| MODULE 1 | INTRODUCTION | |
| MODULE 2 | SYSTEMS ANALYSIS | STEP 1 |
| MODULE 3 | MANPOWER ANALYSIS | STEP 2 |
| MODULE 4 | TRAINING ANALYSIS | STEP 3 |
| MODULE 5 | PERSONNEL ANALYSIS | STEP 4 |
| MODULE 6 | IMPACT ANALYSIS | STEP 5 |
| MODULE 7 | TRADEOFF ANALYSIS | STEP 6 |

# INTRODUCTION

- USE OF THE METHODOLOGY
- ANALYTICAL LOGIC ASSUMPTIONS
- BENEFITS OF COMPARABILITY ANALYSIS
- CAPABILITIES OF COMPARABILITY ANALYSIS
- THE BASIC APPROACH
- STEPS IN HARDMAN MODEL

AD-A164 628 ARMY HARDMAN FAMILIARIZATION REPORT(U) DYNAMICS RESEARCH CORP WILMINGTON MA R B WESSLING ET AL. JAN 85 E-9743U DABT60-84-C-0077 3/4

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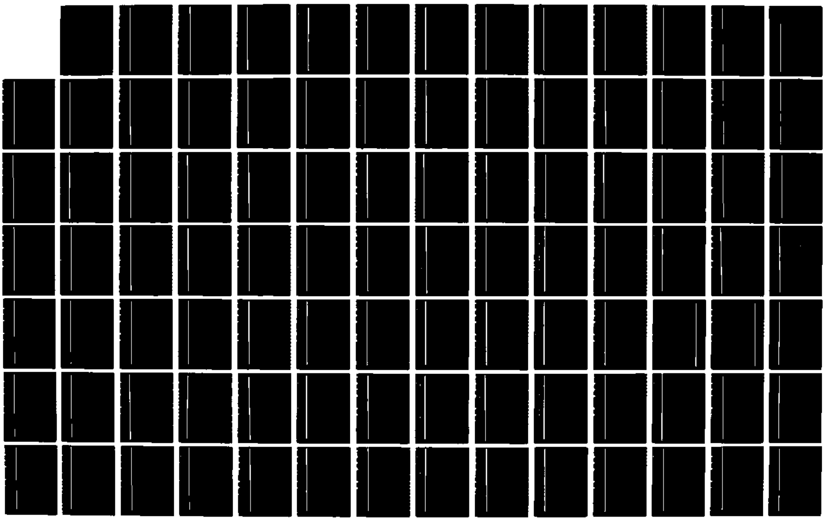
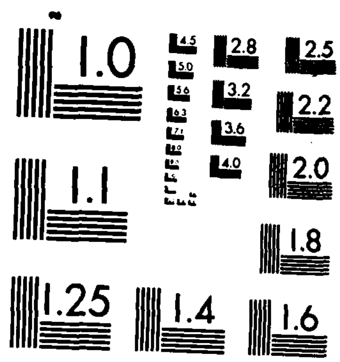


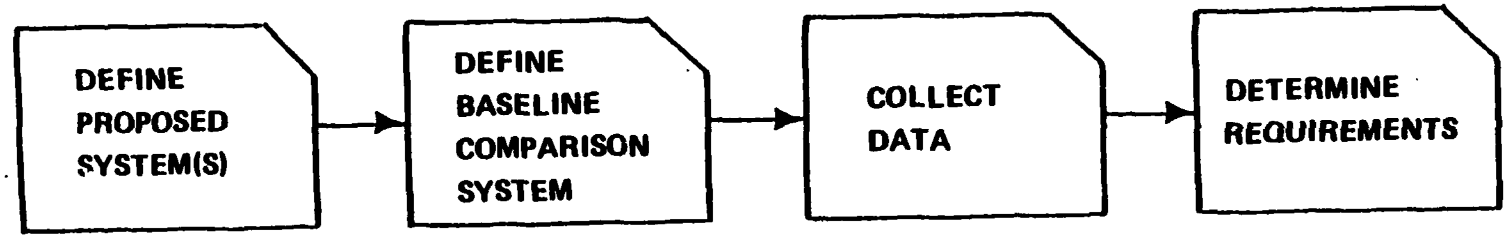



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

# USE OF THE METHODOLOGY

| DSARC MILESTONE | PRE-0 | 0 | I | II | III |
|---|---|---|---|---|---|
| DSARC PHASE | MISSION AREA ANALYSES | CONCEPTUAL | VALIDATION | FULL-SCALE DEVELOPMENT | PRODUCTION / DEPLOYMENT |
| DEVELOPMENT/ ACQUISITION ACTIVITY | SYSTEM-LEVEL DESIGN | | | DETAILED-LEVEL DESIGN | OPERATION AND SUPPORT |
| APPLICATION OF METHODOLOGY | ESTABLISH BASELINE AND REQUIREMENTS | | SUPPORT TRADE-OFF STUDIES | SUPPORT DETAILED-LEVEL DESIGN EFFORT | EVALUATE FIELD DATA AND PROPOSED CHANGES |

# COMPARABILITY ANALYSIS - THE BASIC APPROACH




- MISSION AREA ANALYSIS
- TECHNOLOGY BASE STUDIES
- REQUIREMENTS DOCUMENTS
- CONTRACTOR STUDIES/PROPOSALS

- MISSION AREA ANALYSIS
- DOD/NATO INVENTORY

- HISTORICAL MAINTENANCE DATA
  - NAVY: 3M
  - AF: 66–1
  - ARMY: SDC
- OPERATOR/CREW

- PROPOSED SYSTEM REQ= f (Δ, BCS DATA)

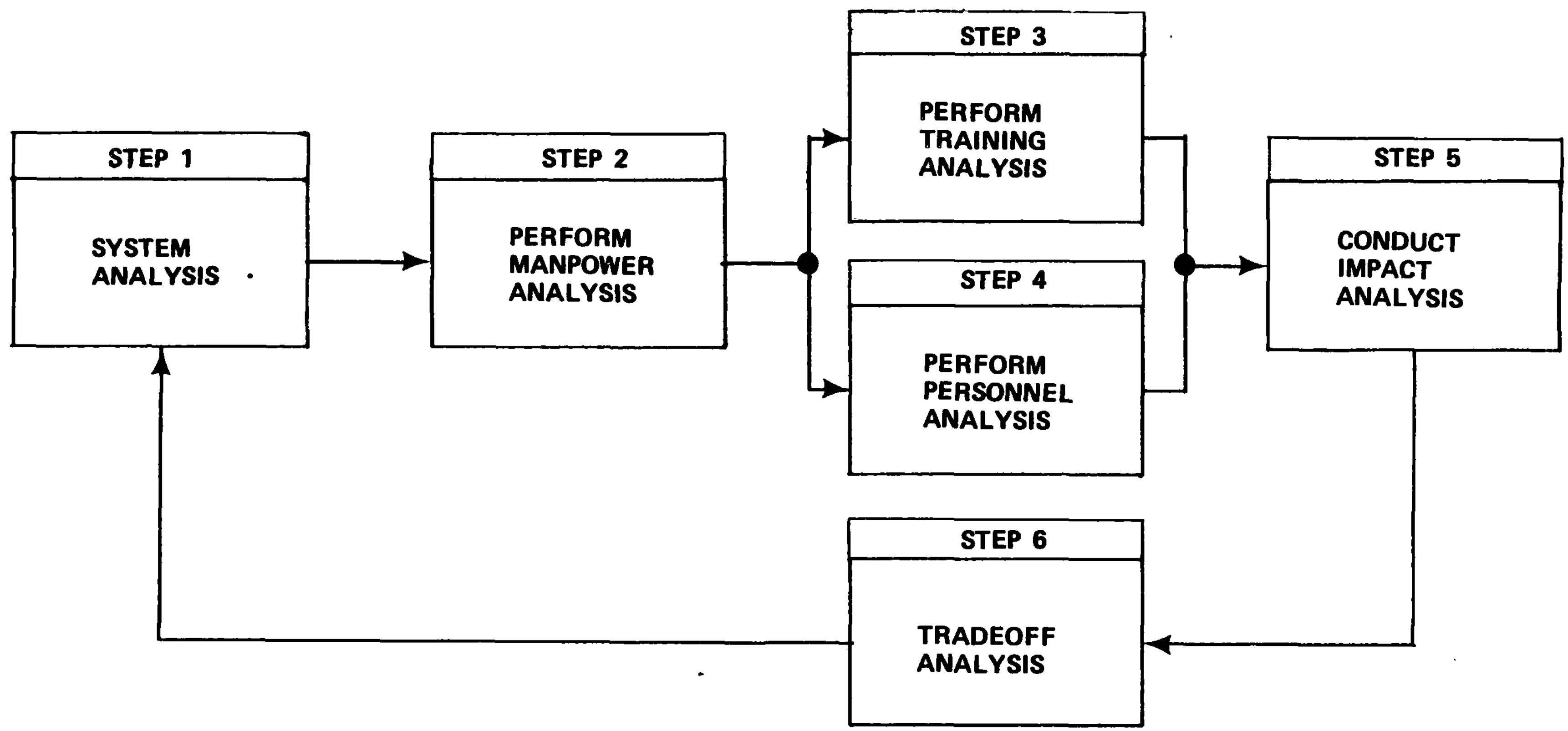
# BENEFITS OF COMPARABILITY ANALYSIS

- EMPIRICAL
- MIRRORS COGNITIVE PROCESSES OF DESIGNERS
- ALLOWS EARLY SPECIFICATION OF MPT REQUIREMENTS IN SIGNIFICANT DETAIL
- PLACES MINIMUM DATA REQUIREMENTS ON HARDWARE DEVELOPER

# CAPABILITIES OF COMPARABILITY ANALYSIS

- MPT REQUIREMENTS ESTIMATION
  - IMPACT ANALYSIS
  - TRADEOFF ANALYSIS
- CONSOLIDATED DATA BASE
  - CONSISTENT WITH LSAR (MIL-STD-1388)
  - AUDIT TRAIL
- FEASIBLE FOR FRONT-END ANALYSIS

# STEPS IN HARDMAN METHODOLOGY



# SYSTEM ANALYSIS (STEP 1)

| | |
|---|---|
| • IDENTIFY GENERAL MISSION REQUIREMENTS | 1A |
| • FUNCTIONAL REQUIREMENTS ANALYSIS | 1B |
| • EQUIPMENT COMPARABILITY ANALYSIS | 1C |
| • RELIABILITY AND MAINTAINABILITY | 1D |
| • OPERATOR AND MAINTAINER TASK IDENTIFICATION | 1E |

# IDENTIFY GENERAL MISSION REQUIREMENTS
# (STEP 1A)

GENERAL

- MAA DRIVEN
- THREAT DRIVEN
- HARDWARE FOCUSED

DETAILED

- SYSTEMS ORIENTED
- MISSION EVENT
- USAGE FACTORS

# IDENTIFY GENERAL MISSION REQUIREMENTS

CLOSE COMBAT (L)

CLOSE COMBAT (H)

FIRE SUPPORT

AIR DEFENSE

COMMUNICATIONS

COMMAND AND CONTROL

INTELLIGENCE AND ELECTRONIC WARFARE

COMBAT SUPPORT, ENGINEERING & MINE WARFARE

COMBAT SERVICE SUPPORT

AVIATION

NUCLEAR, BIOLOGICAL & CHEMICAL

SPECIAL OPERATIONS FORCES

# ANALYSIS OF MISSION REQUIREMENTS

- THREAT CHARACTERISTICS
- MISSION TASKS ANALYSIS
  - BROAD CATEGORIES
  - BRANCH IMPRINT
- MEASURES OF EFFECTIVENESS
- ESSENTIAL ELEMENTS OF ANALYSIS

# IDENTIFY DETAILED MISSION REQUIREMENTS

DEFINITION OF MISSION

ACTIVITY OR EVENT REQUIRED BY DOCTRINE THAT MAY BE ASSIGNED TO A UNIT OR AN INDIVIDUAL AND BY IMPLICATION TO THE EQUIPMENT THEY OPERATE.

# DETAILED MISSION ANALYSIS GUIDELINES

- WHAT ARE THE RELEVANT SYSTEM OPERATING REQUIREMENTS?
- HOW MAY SYSTEM FUNCTIONS BE ARRAYED OVER TIME?
- WHAT PARTICULAR SEQUENCE OF FUNCTIONS IS DESIRED?
- WHAT ARE THE MISSION EVENTS REQUIRED BY EACH FUNCTION?
- WHAT ARE THE TASKS REQUIRED BY EACH MISSION EVENT?
- WHAT ARE THE OPERATING REQUIREMENTS WHICH APPLY TO FUNCTIONS/MISSION EVENTS/TASKS?

# REQUIRED INPUTS FOR THE DETAILED MISSION ANALYSIS PROCESS

- FUNCTIONAL REQUIREMENTS ANALYSIS
- ENGINEERING DATA
- ARMY DOCUMENTATION
  - GENERIC
  - SYSTEM

# MISSION PROFILE COMPOSITE DETERMINATION

- IDENTIFICATION OF SYSTEM FUNCTIONS
- IDENTIFICATION OF TYPES OF MISSIONS
  - RELATED TO SYSTEM FUNCTIONS/END ITEMS
  - RELATED TO OPERATIONAL REQUIREMENT
    - SUSTAINED
    - INTENSE
    - SURGE
- APPLY OPERATIONAL MODE SUMMARY

# FUNCTIONAL REQUIREMENTS ANALYSIS (STEP 1B)

- THE STARTING POINT
- COLLECT/REVIEW INITIAL INFORMATION
- IDENTIFY SYSTEM REQUIREMENTS
- IDENTIFY SYSTEM REQUIREMENTS (MPT)
- WHY A PREDECESSOR
- GENERIC EQUIPMENT
- ANALYSIS SYSTEM FUNCTIONAL REQUIREMENTS (HARDWARE DRIVEN)
- ANALYSIS SYSTEM FUNCTIONAL REQUIREMENTS (HUMAN/INFORMATION)
- FUNCTIONAL ALLOCATION
- GENERIC TASK TAXONOMY

# THE STARTING POINT

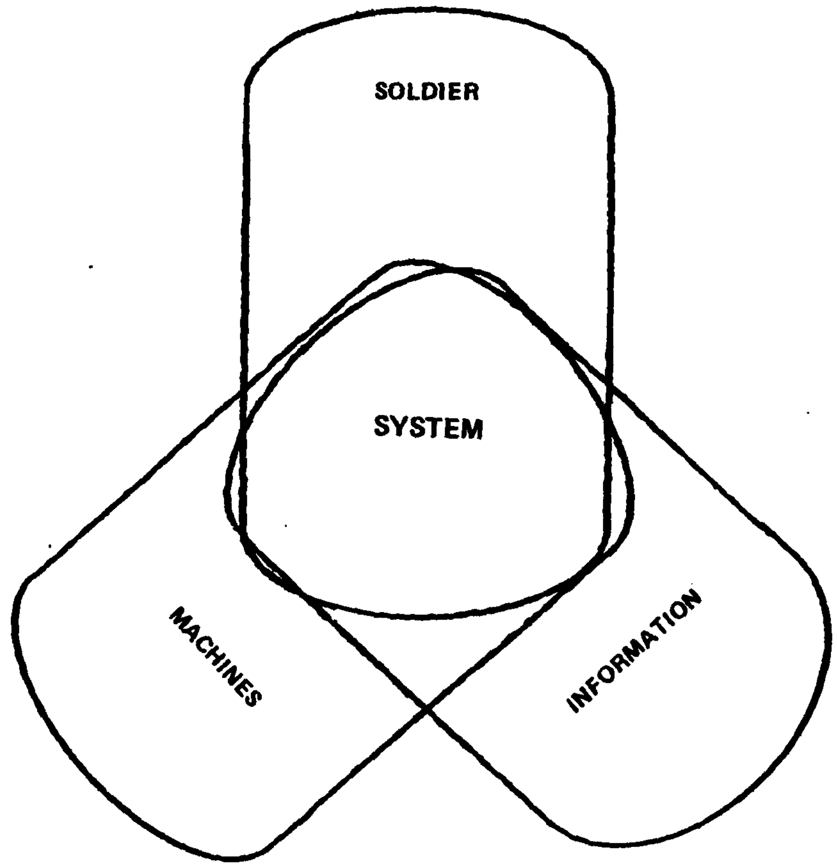
THE EQUATION

| | | |
|---|---|---|
| MAA | | SYSTEM FUNCTIONAL REQUIREMENTS |
| | — | EXISTING SYSTEM FUNCTIONS |
| JMSNS | = | DEFICIENCIES IN EXISTING SYSTEM (ADDITIONAL FUNCTIONAL REQUIREMENTS) |

# COLLECT/REVIEW INITIAL INFORMATION

| FOR SYSTEM UNDER CONSIDERATION | INFORMATION SOURCES |
|---|---|
| 1. WHAT CAPABILITY IS REQUIRED? | • THREAT ANALYSIS<br>• MISSION AREA ANALYSIS |
| 2. WHY? | • JUSTIFICATION FOR MAJOR SYSTEM NEW STARTS (JMSNS) |
| 3. HOW WILL CAPABILITY BE ACQUIRED? | • ACQUISITION POLICY (A109, DoD 5000 SERIES)<br>• PROGRAM MANAGEMENT DIRECTIVES<br>• CONCEPT SOLICITATIONS TO INDUSTRY<br>• TECHNOLOGY BASE STUDIES |

# IDENTIFY SYSTEM MPT REQUIREMENTS



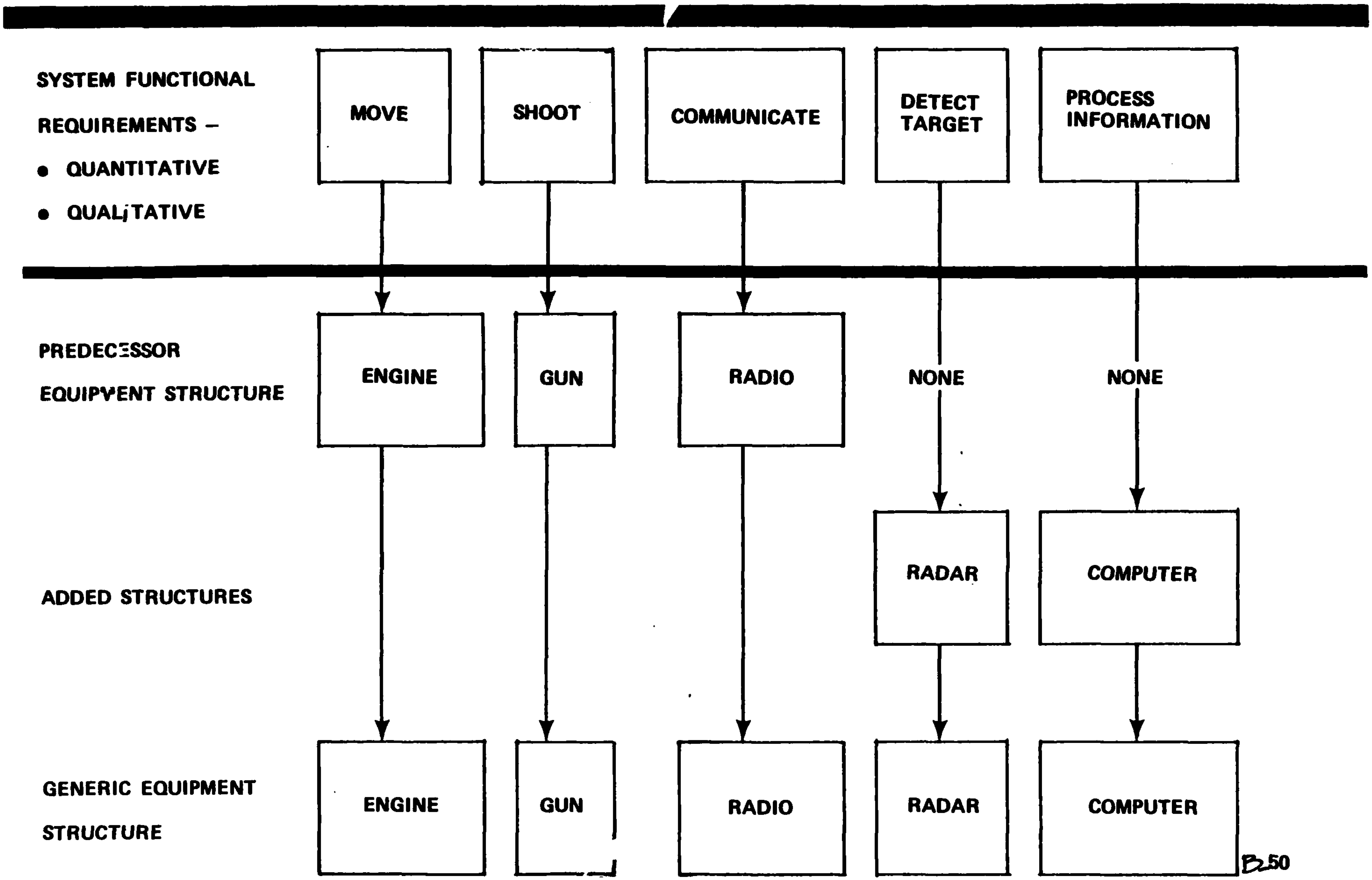

SYSTEM: THAT INTERACTION OF SOLDIER, MACHINES, AND INFORMATION WHICH, WHEN TAKEN AS A WHOLE, IS CAPABLE OF PERFORMING A REQUIRED MISSION.

# WHY PREDECESSOR

- ESTABLISHES SYSTEM OPERATIONAL CONTEXT
- ESTABLISHES SYSTEM ORGANIZATIONAL CONTEXT
- INITIAL CROSSWALK BETWEEN FUNCTIONS: EQUIPMENT: AND TASKS

ANALYTIC "POINT OF DEPARTURE"

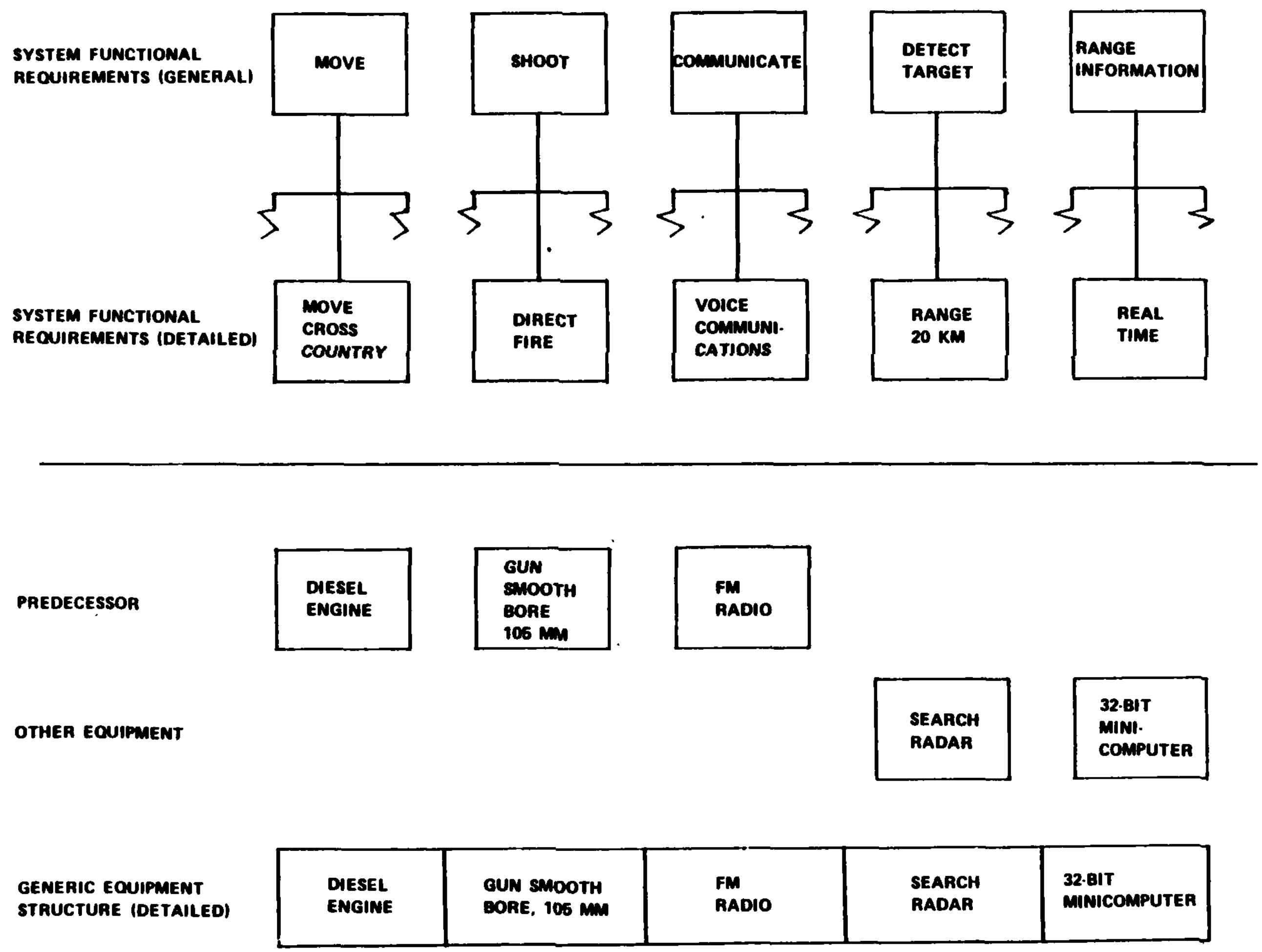
# GENERIC EQUIPMENT




B-50

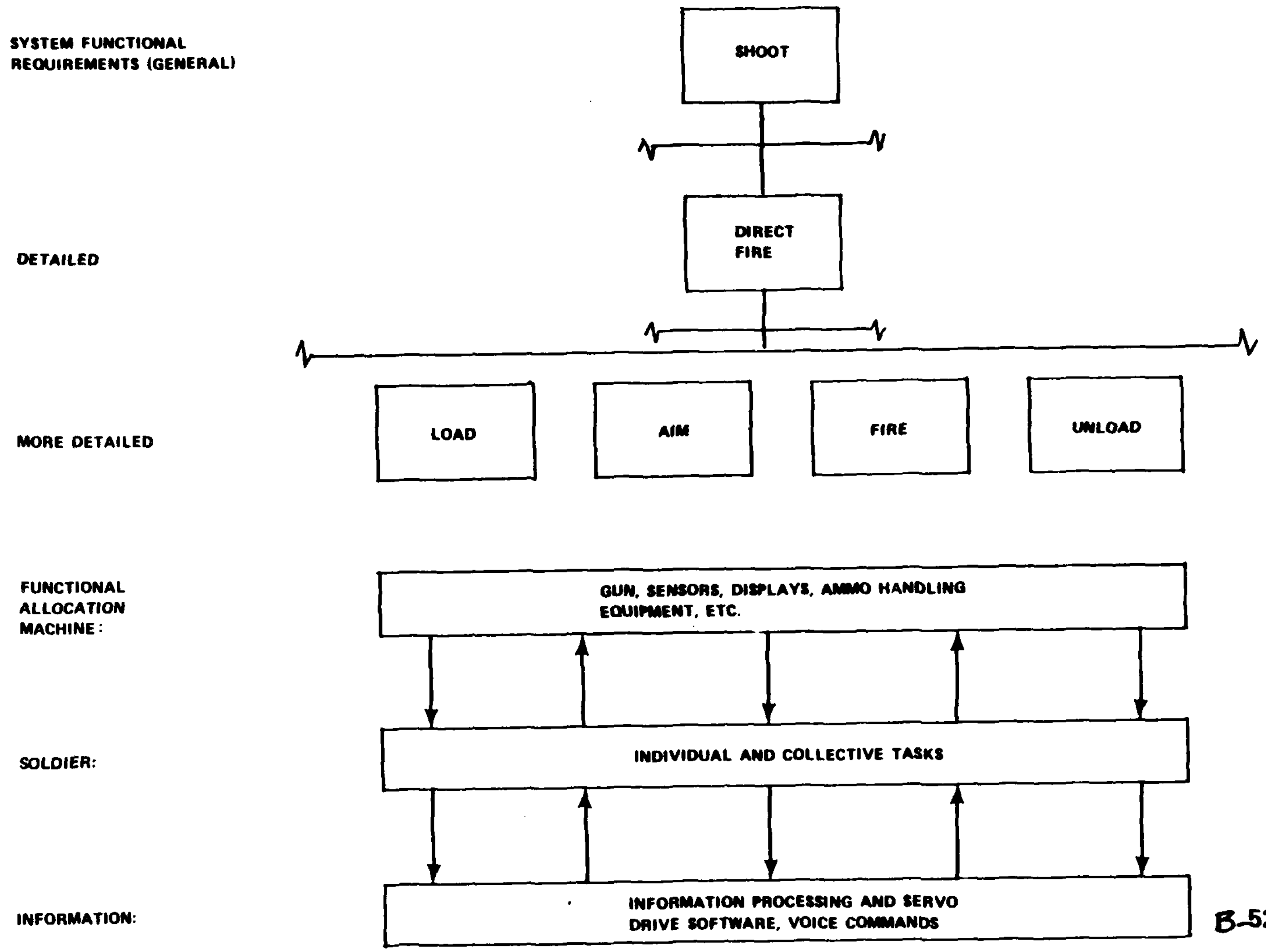
# ANALYZE SYSTEM FUNCTIONAL REQUIREMENTS

## (HARDWARE DRIVEN)



# ANALYZE SYSTEM FUNCTIONAL REQUIREMENTS

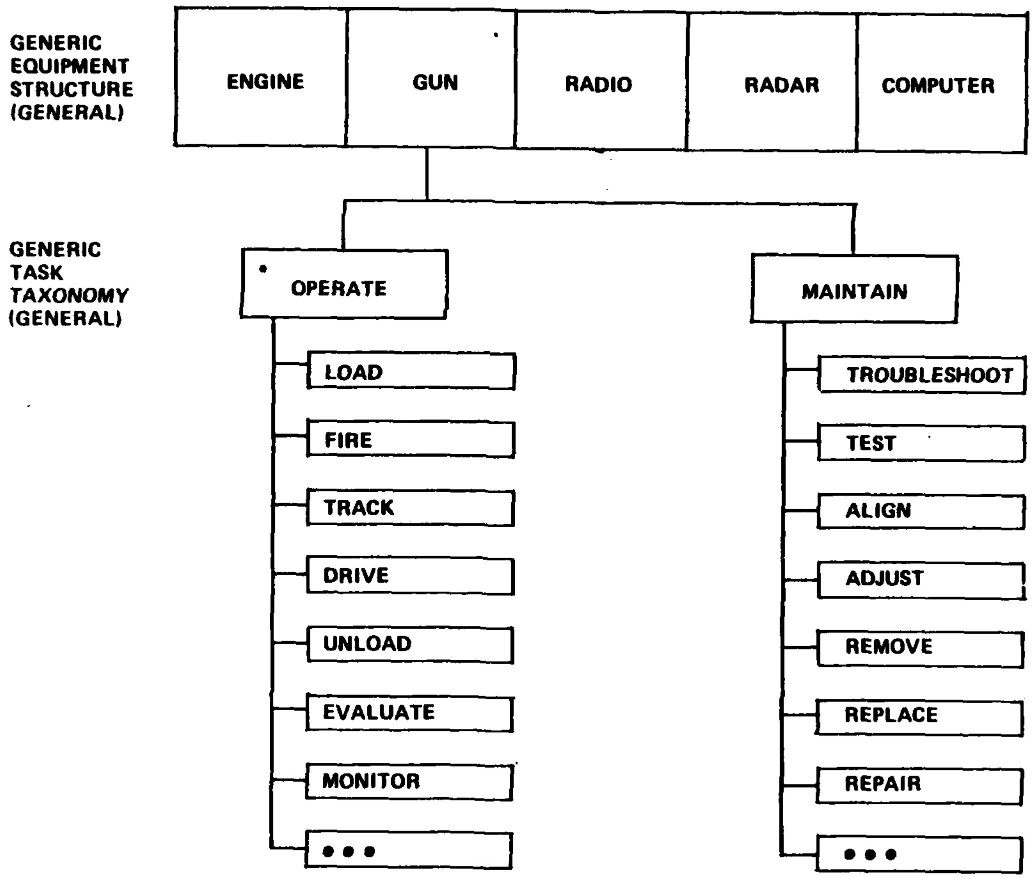
## (SOLDIER INFORMATION)



# FUNCTIONAL ALLOCATION

- DESIGN CONCEPT IS AN IMPLICIT FUNCTIONAL ALLOCATION
- IN HARDMAN, GENERIC DESIGN IS ESTABLISHED FIRST
- SOLDIER AND INFORMATION ALLOCATIONS ARE BASED ON GENERIC DESIGN

# GENERIC TASK TAXONOMY

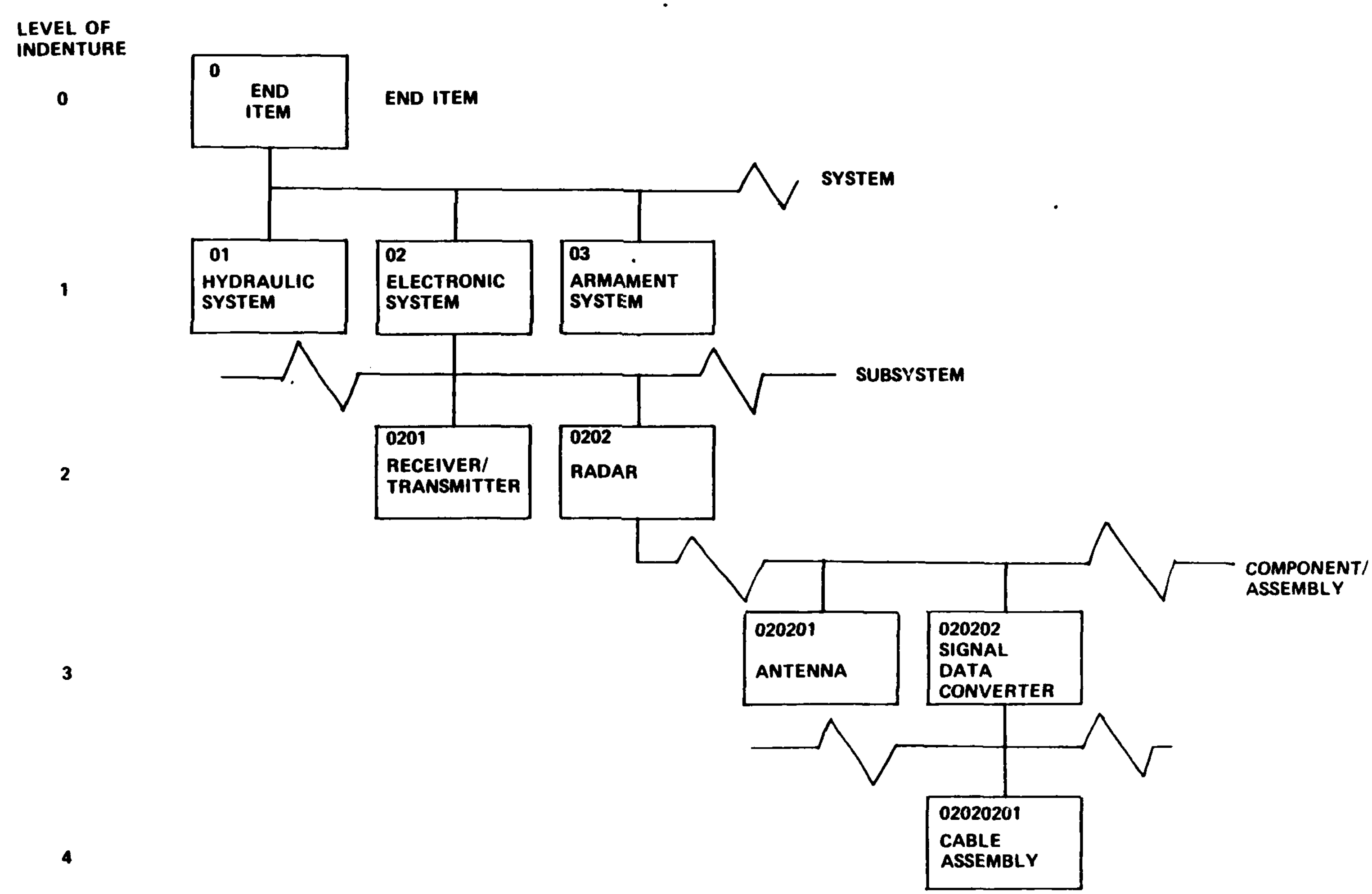



*TACTICS HARDWARE INFORMATION

# EQUIPMENT COMPARABILITY ANALYSIS (STEP 1C)

- STRUCTURE THE GENERIC EQUIPMENT
- DEFINE A PROPOSED SYSTEM(S)
- DEFINE A BASELINE COMPARISON SYSTEM(S) OF MATURE COMPONENTS
- IDENTIFY AND QUANTIFY THE IMPACTS
  - BCS TO PROPOSED SYSTEM IMPROVEMENTS
  - BCS TO PROPOSED SYSTEM DESIGN DIFFERENCES

# LEVEL OF INDENTURE



# HARDMAN SYSTEM DEFINITIONS

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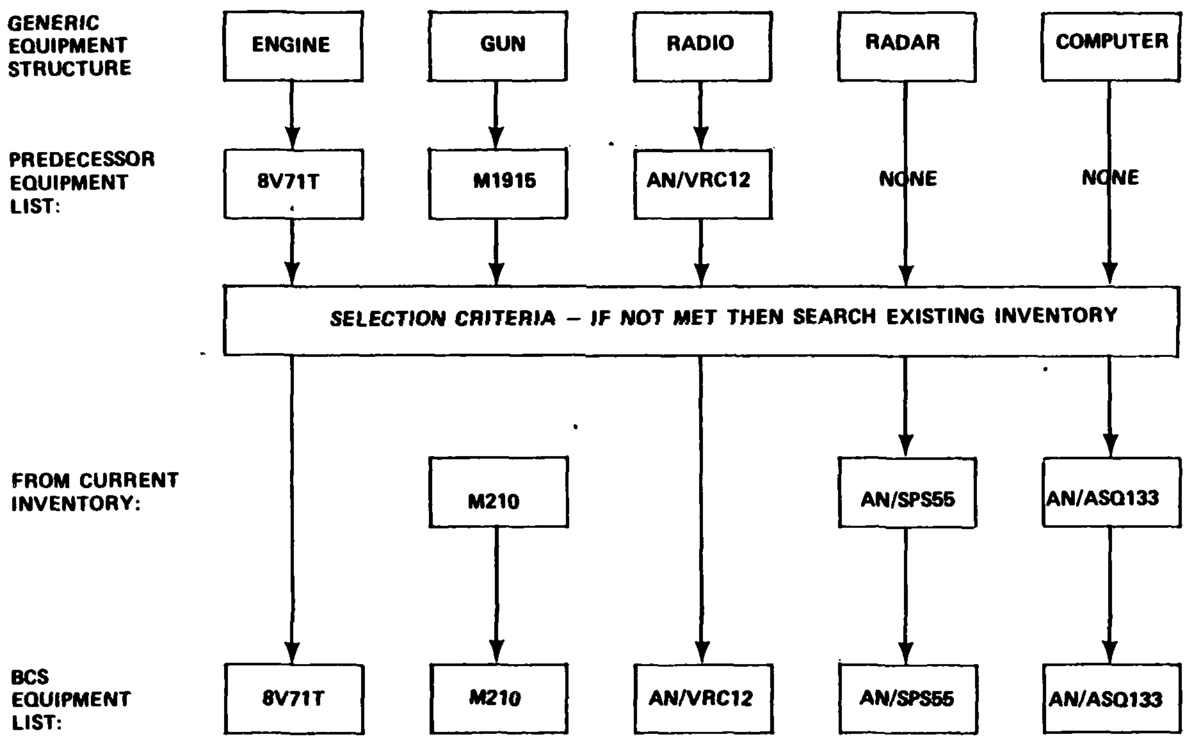
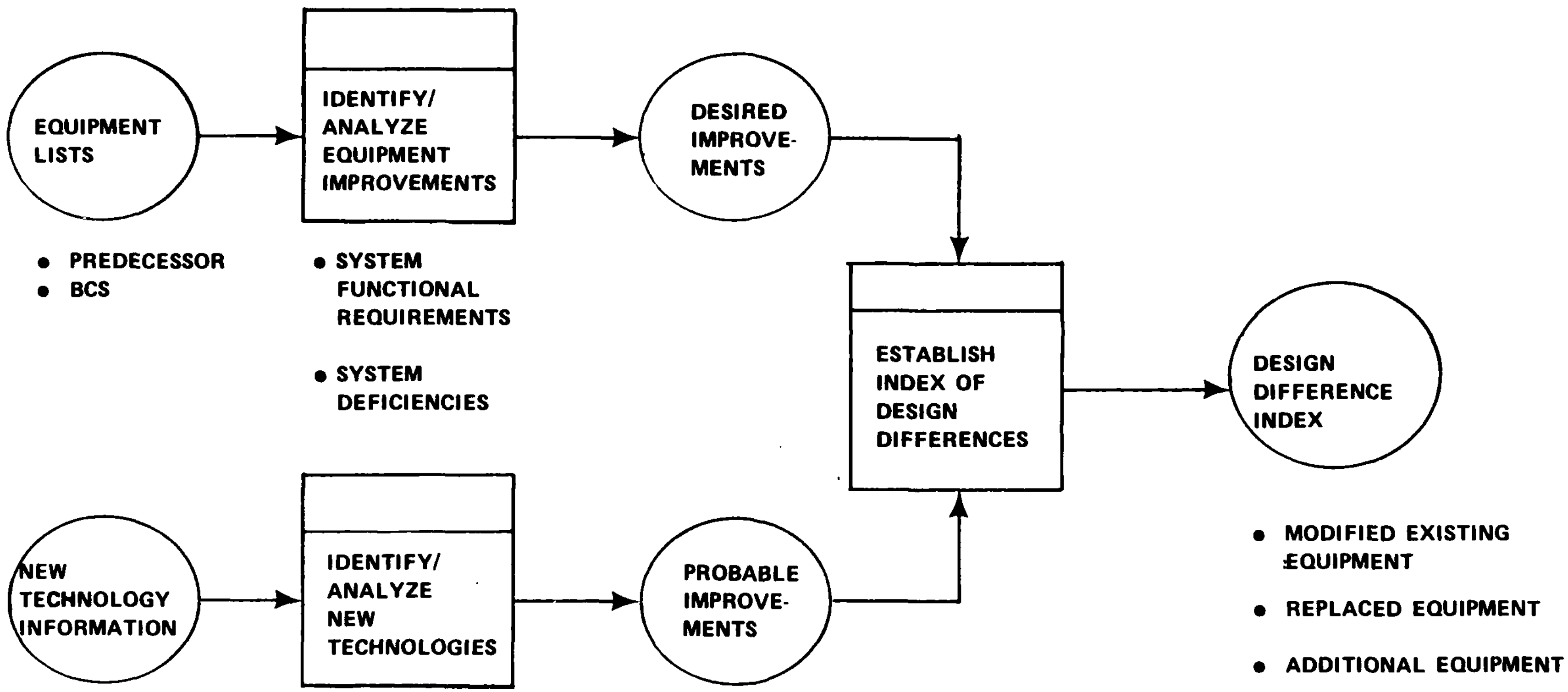
# SELECT BCS COMPONENTS

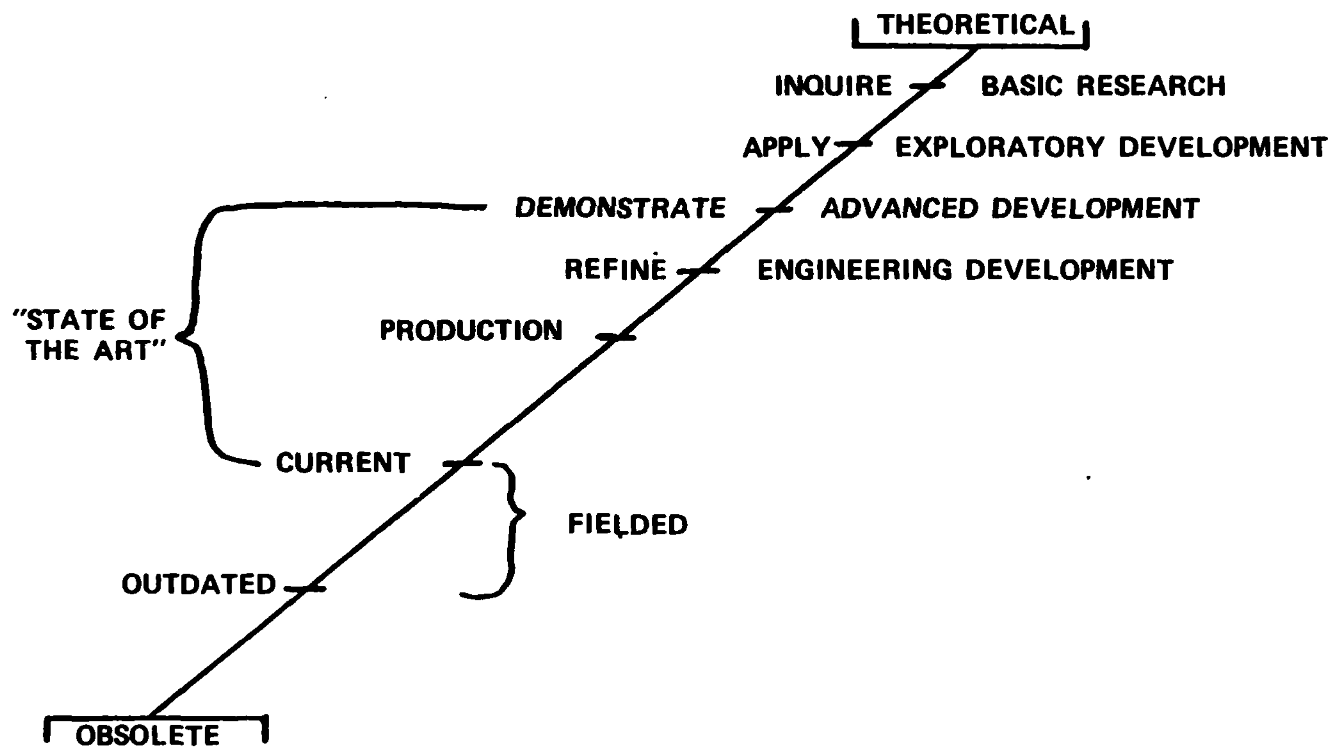


# DETERMINE DESIGN DIFFERENCES

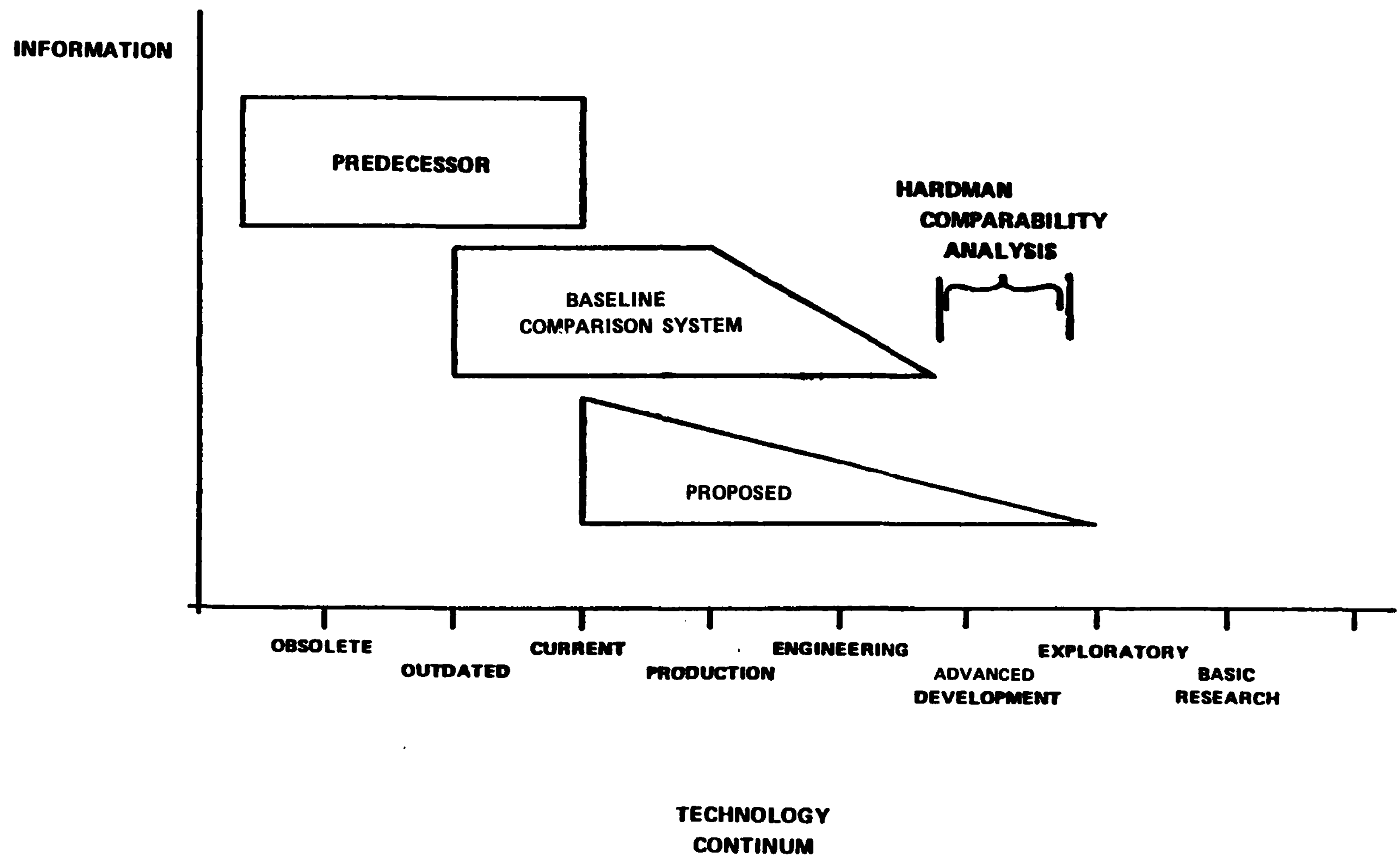


# DETERMINE DESIGN DIFFERENCES

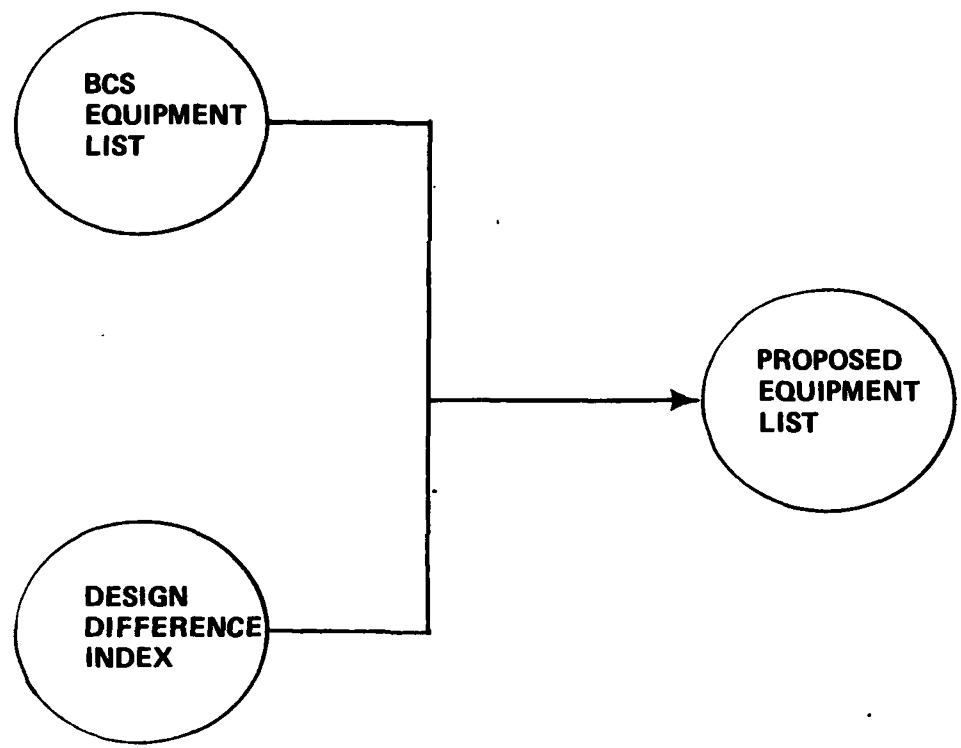
SYSTEM TECHNOLOGY CONTINUUM



# DETERMINE DESIGN DIFFERENCES



# DETERMINE PROPOSED SYSTEM



# RELIABILITY AND MAINTAINABILITY ANALYSIS (STEP 1D)

COMPOSED OF TWO MAJOR ELEMENTS:

- RELIABILITY – THE SYSTEM'S MEASURE OF THE DEMAND FOR MAINTENANCE RESOURCES
- MAINTAINABILITY – THE SYSTEM'S REQUIREMENTS FOR MANPOWER RESOURCES BASED ON PRESCRIBED MAINTENANCE PROCEDURES

# RELIABILITY

DEMAND IS BASED ON:

- DEPENDENCY (METRIC) – SYSTEM'S USAGE
  - HOURS OPERATED
  - ROUNDS FIRED
  - MILES TRAVELED
  - OTHER (TAKE-OFF/LANDINGS)
- FREQUENCY – OCCURRENCE OF DEMAND
  - MAINTENANCE ACTIONS
  - MEAN (TIME/METRIC) BETWEEN MAINTENANCE ACTIONS
- CAUSE – FOCUS TO WHAT HAPPENED
  - HARDWARE
  - NON-HARDWARE
- EFFECTS – STATUS OF HARDWARE
  - INOPERABLE
  - PARTIALLY OPERABLE
  - NON-OPERABLE
  - OPERABLE

# MAINTAINABILITY

RESOURCES CONSUMED BY THESE FACTORS:

- MAINTENANCE ALLOCATION CHART REQUIREMENTS
- MEAN TIME TO REPAIR (MTTR)
- MAINTENANCE MANHOURS PER TASK
- MAINTENANCE RATIO

# OPERATOR TASK IDENTIFICATION
# (STEP 1E)

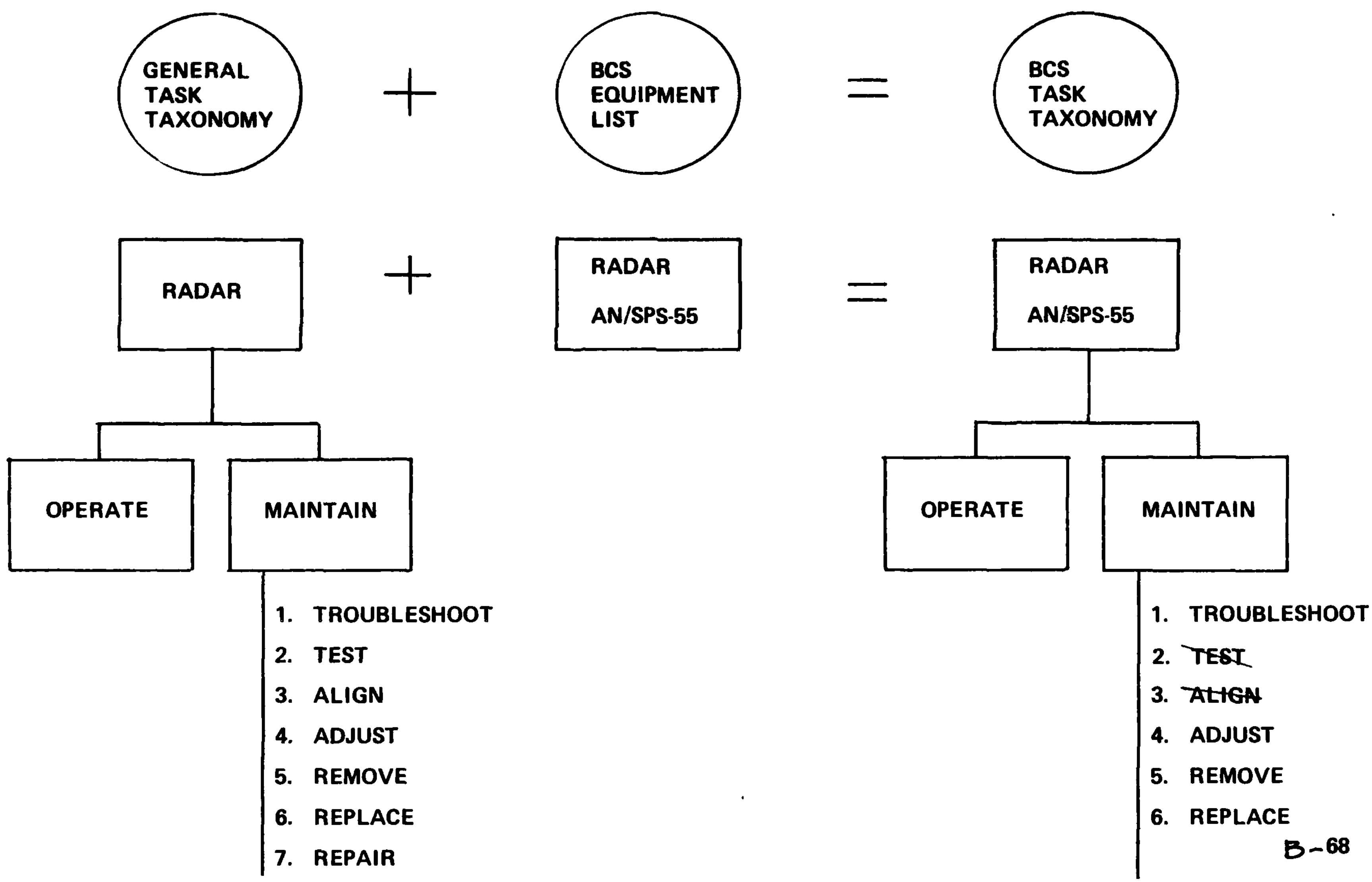
- COLLECTIVE TASKS
  - ARTEP BASED (SIMILAR END ITEM)
  - SCENARIO DRIVEN

- INDIVIDUAL TASKS
  - TASK DATA AVAILABLE
  - BCS EQUIPMENT TASK DATA
  - FUNCTIONAL REQUIREMENTS

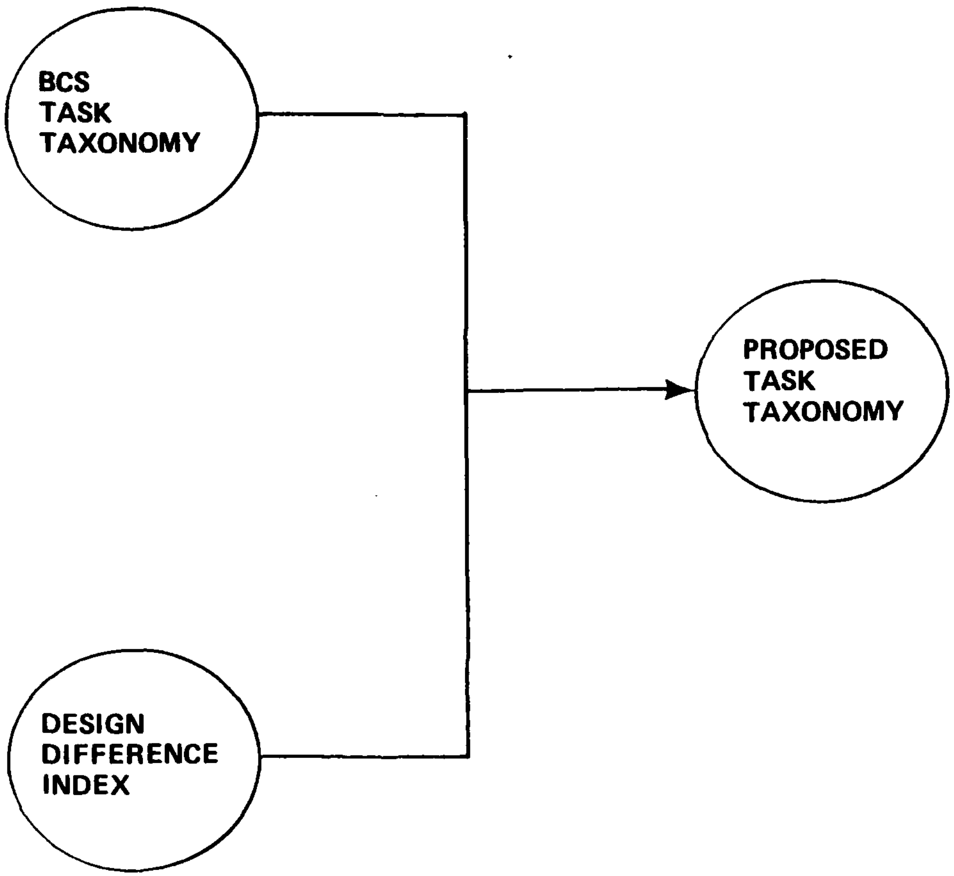
# MAINTENANCE TASK IDENTIFICATION

- SYSTEM MISSIONS/MAINTENANCE REQUIREMENTS
- EQUIPMENT LIST
- LEVEL OF INDENTURE
- LEVEL OF MAINTENANCE
- LEVEL OF REQUIRED DETAIL

# DETERMINE BCS TASKS



# DETERMINE PROPOSED SYSTEM TASKS



# MANPOWER REQUIREMENTS ANALYSIS (STEP 2)

- MOS/GRADE DETERMINATION 2A
- WORKLOAD ANALYSIS 2B
- MANPOWER REQUIREMENTS DETERMINATION 2C

# MOS/GRADE DETERMINATION
# (STEP 2A)

- COMPREHENSIVE PROCESS INVOLVING:

  ANALYSIS OF EXISTING:

  MOS ASSIGNMENTS
  OPERATIONAL/MAINTENANCE CONCEPTS
  DUTY POSITIONS
  TRAINING PROGRAMS
  PERSONNEL STRUCTURE
  TABLES OF ORGANIZATION AND EQUIPMENT
  STANDARDS OF GRADE AUTHORIZATION

  DETERMINATION OF:

  OPERATOR/MAINTAINER SCENARIOS
  WORKLOAD REQUIREMENTS
  MANPOWER REQUIREMENTS
  TRAINING RESOURCE REQUIREMENTS
  PERSONNEL SUPPORTABILITY

- THREE ANALYSIS PHASES

  INITIAL
  REFINEMENT
  FINAL

# INITIAL MOS/GRADE DETERMINATION (PHASE I)

- DETERMINE OPERATIONAL/MAINTENANCE CONCEPTS
- IDENTIFY SYSTEM'S FUNCTIONAL BRANCH AREA
- IDENTIFY CURRENT MOS ASSIGNED TO FIELDED EQUIPMENT/SUBSYSTEMS (PREDECESSOR/BCS)
- IDENTIFY CURRENT MOS FOR SIMILAR EQUIPMENT TECHNOLOGIES/ CATEGORIES FOUND ON PROPOSED SYSTEM
- COMPARE GENERIC TASK REQUIREMENTS TO CURRENT MOS TASK DESCRIPTIONS
- IDENTIFY EXISTING MOS/GRADES IN EXISTING TOE
- IDENTIFY RANGE OF PAYGRADES FOR EXISTING MOS

# REFINE MOS/GRADE DETERMINATION (PHASE II)

- CONSTRUCT OPERATOR AND MAINTAINER SCENARIOS
- DETERMINE DUTY POSITIONS AND ASSOCIATED SKILL LEVELS
- CALCULATE WORKLOAD REQUIREMENTS
- IDENTIFY EXISTING TRAINING TASKS AND COURSES
- REVISE DECISIONS AS REQUIRED

# FINAL MOS/GRADE DETERMINATION
# (PHASE III)

- DETERMINE TRAINING TASKS FOR PROPOSED SYSTEM
- DETERMINE STANDARDS OF GRADE AUTHORIZATION
- REVISE DECISIONS AS REQUIRED

IMPACT ANALYSIS

- ANALYZE TRAINING RESOURCE REQUIREMENTS

  COURSE LENGTHS
  COURSE COSTS
  NUMBERS OF INSTRUCTOR

- ANALYZE PERSONNEL SUPPORTABILITY
- ITERATE THE METHODOLOGY

# WORKLOAD ANALYSIS
# (STEP 2B)

- OPERATOR WORKLOAD ANALYSIS
- OPERATOR WORKLOAD LOGIC
- MAINTAINER WORKLOAD ANALYSIS
- MAINTENANCE WORKLOAD LOGIC
- DETERMINE TOTAL WORKLOAD

# OPERATOR WORKLOAD ANALYSIS

- DEPENDS UPON SYSTEM UNDER ANALYSIS
- SOME WORKLOAD NOT AMENABLE TO MODELING
- ANALYSIS AT LEVEL OF DETAIL NECESSARY TO ARRIVE AT ESTIMATES

# OPERATOR/CREW MANPOWER LOGIC

- DETERMINE MINIMUM OPERATORS PER DISCRETE FUNCTION
- SEQUENCE FUNCTIONS BY DOCTRINE/O&O TO IDENTIFY SERIES/PARALLEL FUNCTIONS
- LARGEST SIMULTANEOUS REQUIREMENT DETERMINES MINIMUM CREW SIZE FOR ONE REPETITION OF SEQUENCE
- REPEAT SEQUENCE TO SATISFY SCENARIO REQUIREMENTS
- AGGREGATE WORKLOAD
- LOAD MINIMUM POSITIONS UP TO INDIVIDUAL CAPACITY
- ADD ADDITIONAL POSITIONS UNTIL ALL WORKLOAD IS ASSIGNED

# MAINTAINER WORKLOAD ANALYSIS

- AGGREGATE BY END ITEM/MAINTENANCE LEVEL
- COMPUTE EQUIPMENT MANHOURS
- BY CATEGORY
  - MAINTENANCE LEVEL
  - EQUIPMENT
  - MOS
  - SKILL LEVEL
  - DUTY POSITION
- AGGREGATE BY NUMBER OF SYSTEMS

# MAINTENANCE WORKLOAD LOGIC

GENERAL: INTENSITY X RELIABILITY X MAINTAINABILITY = WORKLOAD

SPECIFIC:

$$\frac{\text{USE}}{\text{PERIOD}} \times \frac{\text{ACTIONS}}{\text{USE}} \times \frac{\text{MANHOURS}}{\text{ACTION}} = \frac{\text{MANHOURS}}{\text{PERIOD}}$$

# DETERMINE TOTAL WORKLOAD

- OPERATOR WORKLOAD
  - END ITEMS
  - DUTY POSITION
  - SKILL LEVEL
  - MOS
- MAINTAINER WORKLOAD
  - END ITEMS
  - MAINTENANCE LEVELS
  - DUTY POSITION
  - SKILL LEVEL
  - MOS

# MANPOWER REQUIREMENTS DETERMINATION
# (STEP 2C)

GENERAL: $\dfrac{\text{WORKLOAD X FORCE STRUCTURE}}{\text{CAPACITY}} = \text{MANPOWER}$

SPECIFIC:

$$\frac{\boxed{\begin{array}{c}\text{WORKLOAD}\\ \hline \text{TOTAL MANHOURS/ SYSTEM}\end{array}} \times \boxed{\begin{array}{c}\text{FORCE STRUCTURE}\\ \hline \text{SYSTEM DENSITY}\end{array}}}{\boxed{\begin{array}{c}\text{CAPACITY}\\ \hline \text{AVAILABLE MANHOURS/ POSITION}\end{array}}} = \text{POSITION REQUIRED}$$

# TRAINING RESOURCE REQUIREMENTS ANALYSIS (TRRA) (STEP 3)

- TRRA OVERVIEW — 3A
- *TASK COMPARABILITY* — 3B
- COURSE REQUIREMENTS — 3C
- TRAINING COSTS AND RESOURCES DETERMINATIONS — 3D

# TRRA OVERVIEW
# (STEP 3A)

- COMPARABILITY ANALYSIS
  - BASED ON BEST DATA
  - "STEADY STATE" VALUES
  - NEW EQUIPMENT TRAINING IS NOT ESTIMATES
  - FOCUS ON INSTITUTIONAL TRAINING
  - QUALITY OF "BEST DATA" ASSUMED
  - DEVELOPMENT AND ACQUISITION COSTS NOT ESTIMATED
- TRAINING REQUIREMENTS
  - TRAINING MANDAYS
  - TRAINING COSTS
  - INSTRUCTOR REQUIREMENTS

# TRAINING COMPARABILITY ANALYSIS

DEFINE EXISTING TRAINING PROGRAM → IDENTIFY IMPACTS OF DESIGN DIFFERENCES → DEFINE BCS TRAINING PROGRAM → DEFINE PROPOSED SYSTEM TRAINING PROGRAM

**DEFINE EXISTING TRAINING PROGRAM**

- AR 611-201
- SOLDIERS/ COMMANDERS MANUALS
- TRAINER'S GUIDES
- PROGRAMS OF INSTRUCTION (POI)
- ATRM–159 TRAINING COST DATA

**IDENTIFY IMPACTS OF DESIGN DIFFERENCES**

- Δ TASKS
- Δ COURSES
- Δ RESOURCES
- Δ COSTS

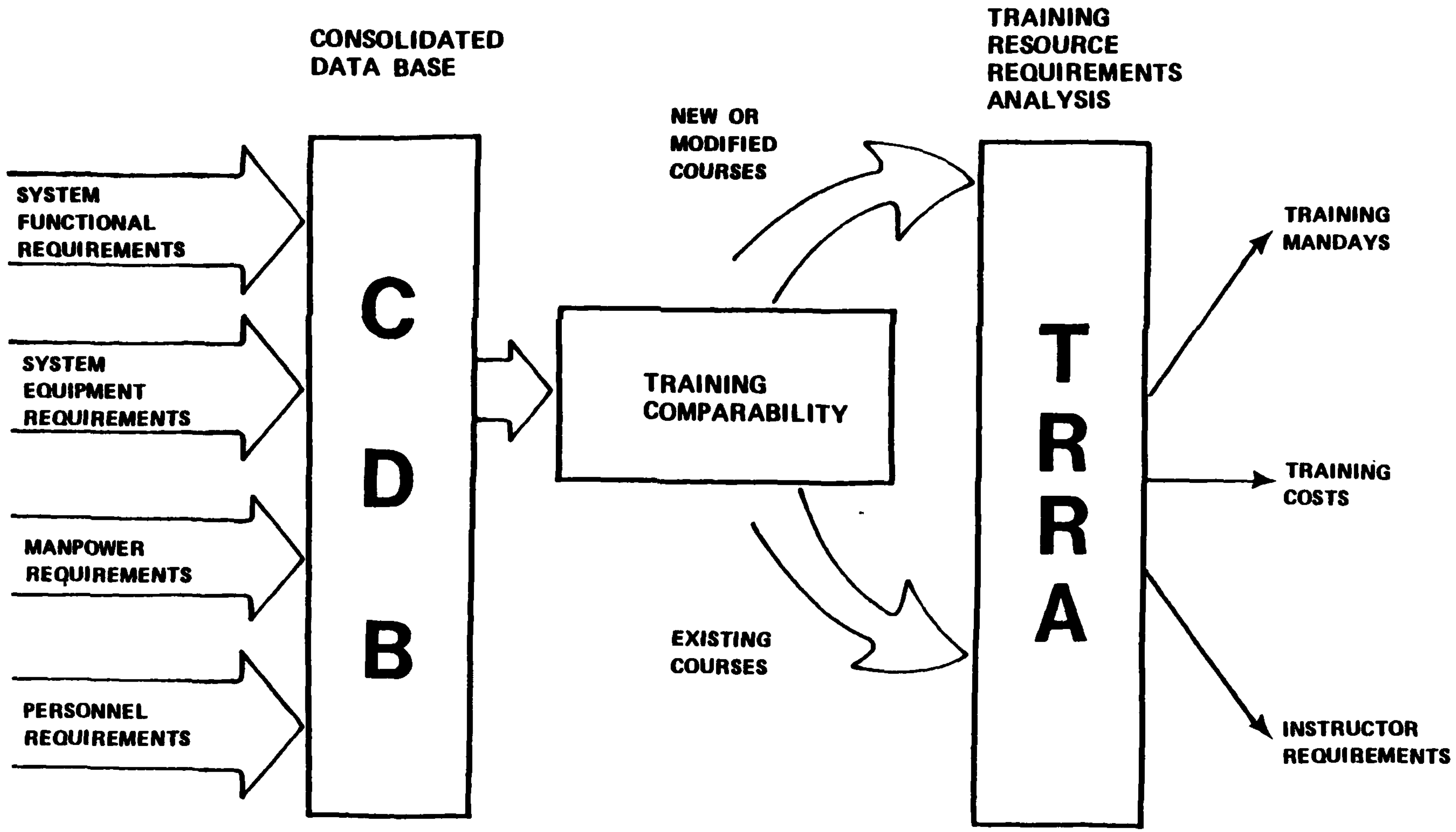
**DEFINE BCS TRAINING PROGRAM**

- REFLECTS DESIGN DIFFERENCES BETWEEN BCS AND EXISTING SYSTEM
- QUASI – POI
  - TASKS
  - COURSES
  - RESOURCES
  - COSTS

**DEFINE PROPOSED SYSTEM TRAINING PROGRAM**

- REFLECTS DESIGN DIFFERENCES BETWEEN PROPOSED SYSTEM AND BCS
- QUASI – POI
  - TASKS
  - COURSES
  - RESOURCES
  - COSTS

# TRAINING REQUIREMENTS



# TASK COMPARABILITY
# (STEP 3B)

- ANALYZE EXISTING TASKS
  - ANALYZE ONLY CHANGES TO
    - FREQUENCY
    - SKILL LEVEL
- DETERMINE TASK CHARACTERISTICS
- ASSIGN TASKS TO MOS AND SKILL LEVEL
- NOT TYPICALLY DONE EARLY IN LCSMM

# ANALYZE EXISTING TASKS

- TO DELETE UNSUPPORTED TASKS

- TO MODIFY TASKS TO MEET NEW CRITERIA
  - FREQUENCY OF TASK PERFORMANCE IS:
    - MORE OFTEN
    - LESS OFTEN
  - SKILL LEVEL
    - MOVES TASK TO ANOTHER SKILL LEVEL
    - MOVES TASK TO ANOTHER MOS/SL

# DETERMINE TASK CHARACTERISTICS

- MOS
- SKILL LEVEL
- DUTY POSITION (CREW)
- TRAINING SETTING
- MEDIA
- TRAINING SUPPORT
- FREQUENCY
- DIFFICULTY
- IMPORTANCE

# ASSIGN TASKS TO MOS AND SKILL LEVEL

- BASED ON HIGH COMPATIBILITY OF
  - OLD MOS WITH
  - NEW MOS
- SKILLS AND KNOWLEDGE COMPARISON
- VERIFY SELECTION BASED UPON
  - MANPOWER CRITERIA
  - WORKLOAD ANALYSIS
  - ARMY TRAINING SYSTEM

# COURSE REQUIREMENTS
# (STEP 3C)

- ASSIGN TASKS TO TRAINING
- ASSIGN TASKS TO TRAINING SETTING
- IDENTIFY EXISTING COURSES OF INSTRUCTION
- MODIFY/ADD COURSES OF INSTRUCTION
- IDENTIFY TRAINING DEVICES

# ASSIGN TASKS TO TRAINING

- USE "DIF" ALGORITHM
- USE ISD/SAT PROCEDURES
- SEEK USER REVIEW

# ASSIGN TASKS TO TRAINING SETTING

- TRADOC PAM 351-4 (JOB AND TASK ANALYSIS HANDBOOK) CRITERIA
- TRADOC PAM 350-30 (INTERSERVICE PROCEDURES FOR INSTRUCTIONAL SYSTEMS DEVELOPMENT) CRITERIA
- COMPARABILITY ANALYSIS

# IDENTIFY EXISTING COURSES OF INSTRUCTION

- DA PAM 351-4 (U.S. ARMY FORMAL SCHOOLS CATALOG)
- DA PAM 351-9 (EPMS MASTER TRAINING PLAN)
- MOS TRAINING COST HANDBOOK (MOSB)
- INTERSERVICE TRAINING REVIEW ORGANIZATION
- U.S. AIR FORCE
- U.S. NAVY
- U.S. MARINE CORPS
- U.S. COAST GUARD
- INDUSTRY

# MODIFY/ADD COURSES OF INSTRUCTION

- AT PROGRAM OF INSTRUCTION (POI) LEVEL
- AT ANNEX LEVEL
- AT TASK LEVEL
  - HARDWARE
  - TACTICAL
  - SOFTWARE

# IDENTIFICATION OF CANDIDATE TRAINING DEVICES

- USES COMPARABILITY ANALYSIS
- SYSTEM CRITERIA
  - INDIVIDUAL TASK SUPPORTED
  - COLLECTIVE TASK SUPPORTED
  - BOTH
- TYPES OF DEVICE
  - NON-SYSTEM
  - SYSTEM
- USE OF DEVICE
  - WHOLE TASK
  - PART TASK

# TRAINING COSTS AND RESOURCES
# (STEP 3D)

DETERMINATION OF:

- TRAINING MANDAYS
- INSTRUCTORS
- COURSE COSTS

# DETERMINATION OF NUMBER OF INSTRUCTORS (SCHOOL)

- FOLLOWS DA PAM 570-558 (STAFFING GUIDE FOR U.S. ARMY SERVICE SCHOOLS)
  - LIST HOURS OF INSTRUCTION BY TYPE OF INSTRUCTION
  - INSTRUCTOR CONTACT HOURS (ICH) DETERMINED
  - STUDENT/INSTRUCTOR RATIOS INCLUDED
  - OPTIMUM CLASS SIZE DETERMINED
  - COMPUTE ICH FOR EACH TYPE OF INSTRUCTION
  - COMPUTE POI ICH X COURSE FREQUENCY
  - COMPUTE MONTHLY ICH INTO EQUATION
- FOLLOWS TRAMEA (TRADOC MANAGEMENT ENGINEERING ACTIVITY) PROCEDURES

# DETERMINATION OF TRAINING MAN-DAYS

- PRESENT POI USED AS BASELINE
- ADD/MODIFY/DELETE
  - ANNEX
  - TRAINING OBJECTIVE
- QUASI-POI USED FOR COST ESTIMATE

# DETERMINATION OF COURSE COSTS

- USES ARMY COST ANALYSIS PROGRAM (MOS TRAINING COSTS) [RCS ATRM-159(R1)] AS INPUT

- ADJUSTS/RECALCULATES COSTS DUE TO CHANGES IN TRAINING PARAMETERS

  - COURSE LENGTH
  - NUMBER OF GRADUATES
  - ATTRITION RATE

- COSTS AGGREGATED BY

  - STUDENT
  - COURSE
  - MOS
  - SYSTEM

# PERSONNEL REQUIREMENTS ANALYSIS (STEP 4)

- PERSONNEL REQUIREMENTS 4A
- PERSONNEL REQUIREMENTS ANALYSIS 4B
- COMPARATIVE PERSONNEL STRUCTURE 4C

# PERSONNEL REQUIREMENTS
# (STEP 4A)

- PERSONNEL STRUCTURE REQUIREMENTS

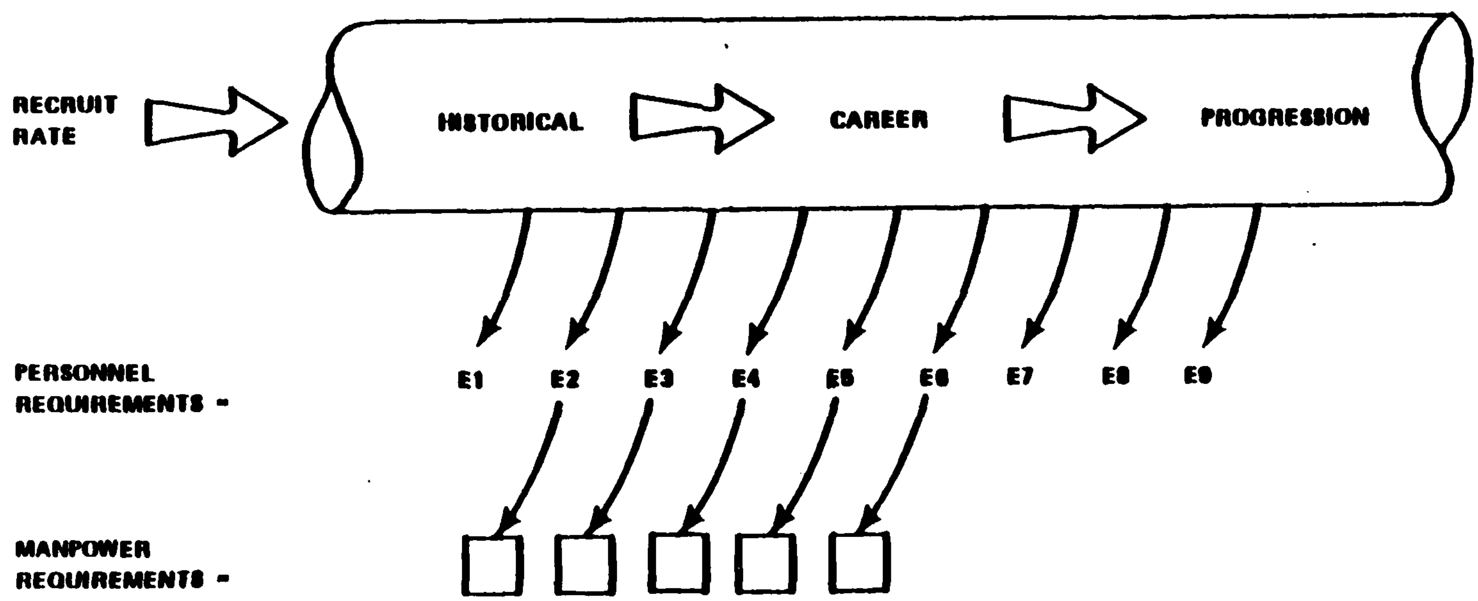
  DIRECT MANPOWER REQUIRED BY THE SYSTEM PLUS ADDITIONAL PERSONNEL REQUIRED TO KEEP THE MANPOWER SPACES FILLED OVER TIME

- CALCULATED USING PROMOTION AND ATTRITION RATES FROM DEFENSE MANPOWER DOCUMENTATION CENTER (DMDC) AND TRAINEE, TRANSIENT, HOLDEES AND STUDENT (TTHS) RATES FROM MILPERCEN

- CALCULATED ON A STEADY STATE ANNUAL BASIS

- ANNUAL RECRUITS ARE THE INTAKE REQUIRED TO SUPPORT THE PERSONNEL STRUCTURE GENERATED BY THE SYSTEM

# PERSONNEL REQUIREMENTS ANALYSIS
# (STEP 4B)



# COMPARATIVE PERSONNEL STRUCTURE
# (STEP 4C)

MOS = 13xx RECRUITS PER YEAR = 606.4

| PAYGRADE | PERSONNEL REQUIREMENTS | UNADJUSTED MANPOWER | TTHS ADJUSTED MANPOWER | PERSONNEL TO BE TRAINED PER YR | MANPOWER LOSSES PER YR | OVERHEAD LOSSES PER YR |
|---|---|---|---|---|---|---|
| E-1 | 331.5 | 0 | 0 | 606.4 | 0 | 606.4 |
| E-2 | 205.3 | 0 | 0 | 434.6 | 0 | 434.6 |
| E-3 | 307.5 | 294.0 | 307.5 | 360.7 | 360.7 | 0.0 |
| E-4 | 441.3 | 112.0 | 117.4 | 278.9 | 74.2 | 204.7 |
| E-5 | 245.3 | 112.0 | 115.4 | 118.7 | 55.8 | 62.9 |
| E-6 | 199.0 | 56.0 | 57.5 | 59.1 | 17.1 | 42.0 |
| E-7 | 96.0 | 14.0 | 14.0 | 30.1 | 4.4 | 25.7 |

MOS = 13xx RECRUITS PER YEAR = 390.7

| PAYGRADE | PERSONNEL REQUIREMENTS | UNADJUSTED MANPOWER | TTHS ADJUSTED MANPOWER | PERSONNEL TO BE TRAINED PER YR | MANPOWER LOSSES PER YR | OVERHEAD LOSSES PER YR |
|---|---|---|---|---|---|---|
| E-1 | 213.6 | 0 | 0 | 390.7 | 0 | 390.7 |
| E-2 | 132.3 | 126.0 | 132.3 | 280.1 | 280.1 | 0.0 |
| E-3 | 198.2 | 168.0 | 175.7 | 232.4 | 206.1 | 26.3 |
| E-4 | 284.4 | 112.0 | 117.4 | 179.7 | 74.2 | 105.6 |
| E-5 | 158.1 | 112.0 | 115.4 | 76.5 | 55.8 | 20.7 |
| E-6 | 128.3 | 56.0 | 57.5 | 38.1 | 17.1 | 21.0 |
| E-7 | 61.9 | 14.0 | 14.0 | 19.4 | 4.4 | 15.0 |

# IMPACT ANALYSIS (STEP 5)

- ESTABLISH RESOURCE AVAILABILITY 5A
- DETERMINE CRITICAL REQUIREMENTS 5B
- SUPPORTABILITY ASSESSMENT 5C
- EVALUATE SYSTEM LEVEL MPT IMPACTS 5D
- EVALUATE FORCE LEVEL MPT IMPACTS 5E

# IMPACT ANALYSIS

ASSESS SUPPLY VS. DEMAND SENSITIVITIES

- IDENTIFY SHORTFALL/HIGH DRIVERS OF RESOURCE REQUIREMENTS.
- DETERMINE THE INFLUENCE WHICH CHANGES IN DEMAND WILL HAVE ON PROJECTED SUPPLY.

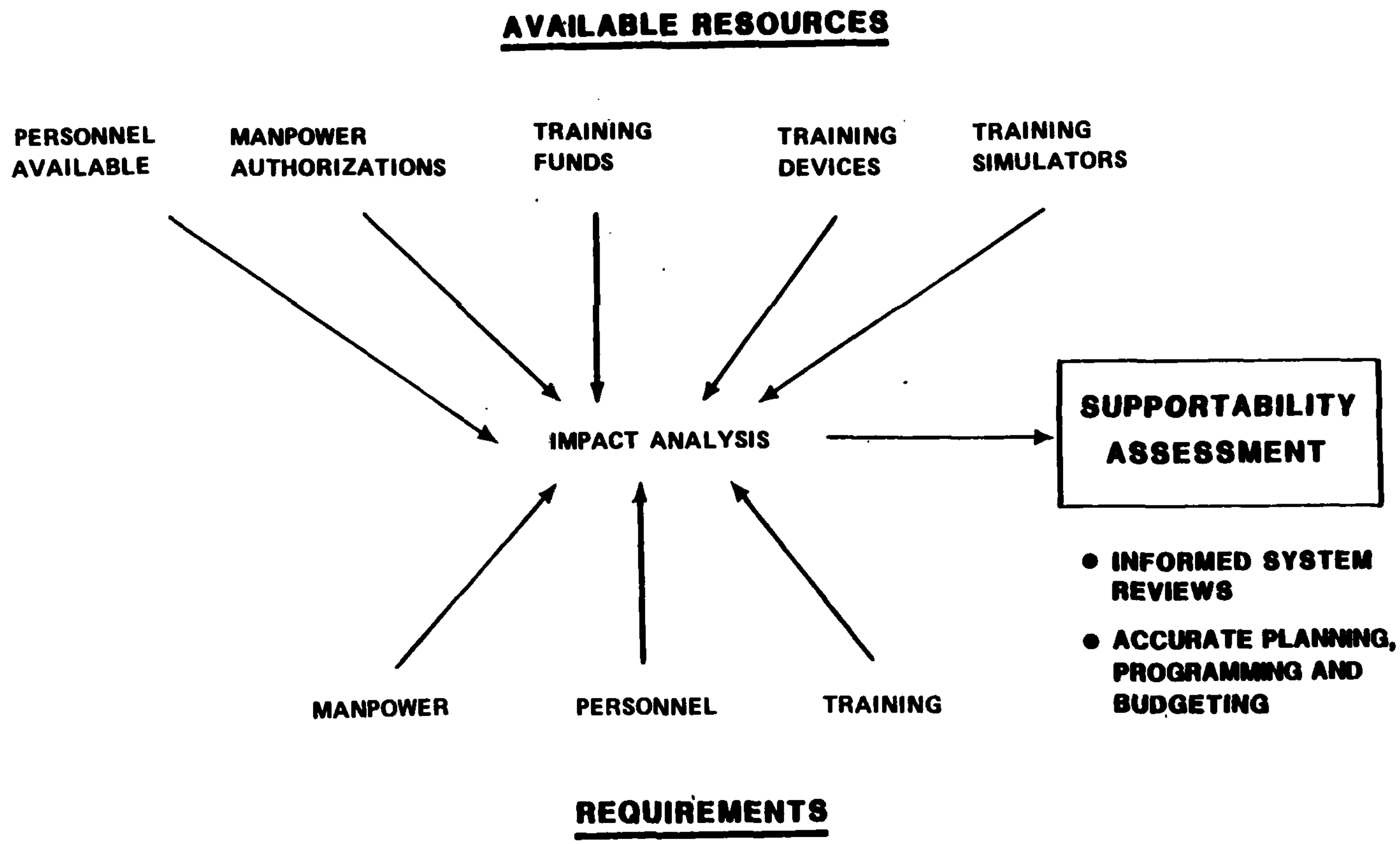
# ESTABLISH RESOURCE AVAILABILITY
# (STEP 5A)

- TRAINING
  - DETERMINE AVAILABILITY OF INSTRUCTION
  - DETERMINE AVAILABILITY OF OTHER TRAINING RESOURCES
- PERSONNEL
  - ACQUIRE PERSONNEL STRENGTH PROJECTIONS
  - DETERMINE AVAILABILITY OF APPLICABLE MOS

# DETERMINE CRITICAL RESOURCE REQUIREMENTS (STEP 5B)

- TRAINING
  - OPERATOR'S TRAINING
  - MAINTAINER'S TRAINING
  - REPAIRER'S TRAINING
- *PERSONNEL*
  - IDENTIFY CRITICAL REQUIREMENTS FOR MOSs
  - IDENTIFY REQUIREMENTS FOR NEW MOSs

# SUPPORTABILITY ASSESSMENT (STEP 5C)



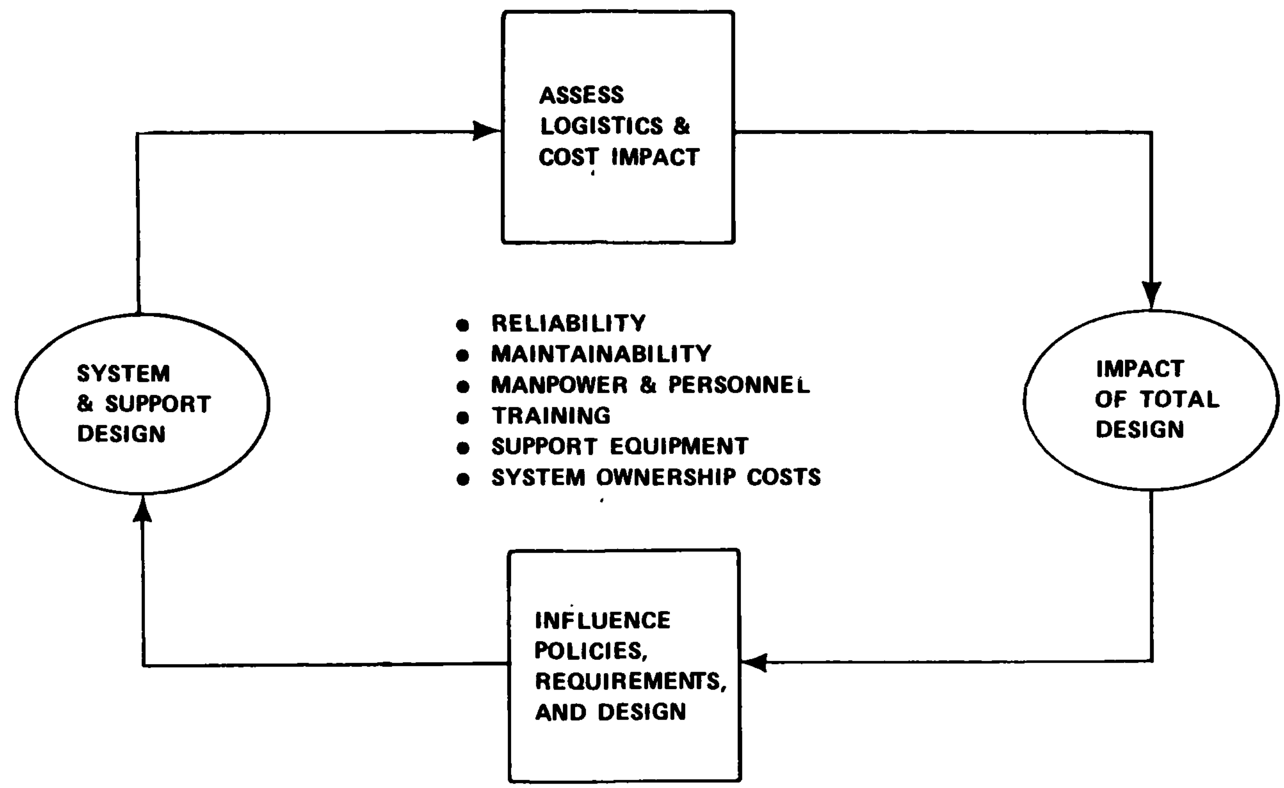
# EVALUATE MPT IMPACT AT SYSTEM LEVEL
# (STEP 5D)

- ARRAY HIGH DRIVERS BY CATEGORY (MPT)
- RANK HIGH DRIVERS WITHIN CATEGORIES (MPT)
- ASSESS RISK
  - TECHNOLOGICAL RISK
  - IMPLEMENTATION RISK
- ESTABLISH USER CONFIDENCE

# EVALUATE MPT IMPACTS AT FORCE LEVEL

- ARRAY CRITICAL REQUIREMENTS BY FORCE LEVEL
  - BATTALION
  - DIVISION
  - CORPS
  - TOTAL ARMY
- EVALUATE REALLOCATING RESOURCES TO DIFFERENT LEVELS
- BASIS FOR MAINTENANCE CONCEPT TRADEOFFS (E.G., 2- VS. 3-LEVEL MAINTENANCE)

# TRADEOFF CAPABILITY
# (STEP 6)



# HARDMAN PRODUCTS

- QUANTIFIED MANPOWER REQUIREMENTS (BY MOS & SKILL LEVEL)
- QUANTIFIED SUSTAINMENT REQUIREMENTS – PERSONNEL
- PERSONNEL CONSIDERATIONS THAT REQUIRE CLOSE EVALUATION AND FUTURE MONITORING
- PROJECTED TRAINING INCREASES (BY MOS)
- ANNUAL INSTRUCTOR REQUIREMENTS
- PROJECTED ANNUAL TRAINING COSTS
- INITIAL LOGISTICS SUPPORT ANALYSIS DATA
- IDENTIFICATION OF AREAS FOR POSSIBLE SYSTEM DEVELOPMENT CHANGES TO INCREASE PERSONNEL SUPPORTABILITY
- SYSTEM SPECIFIC DATA BASE

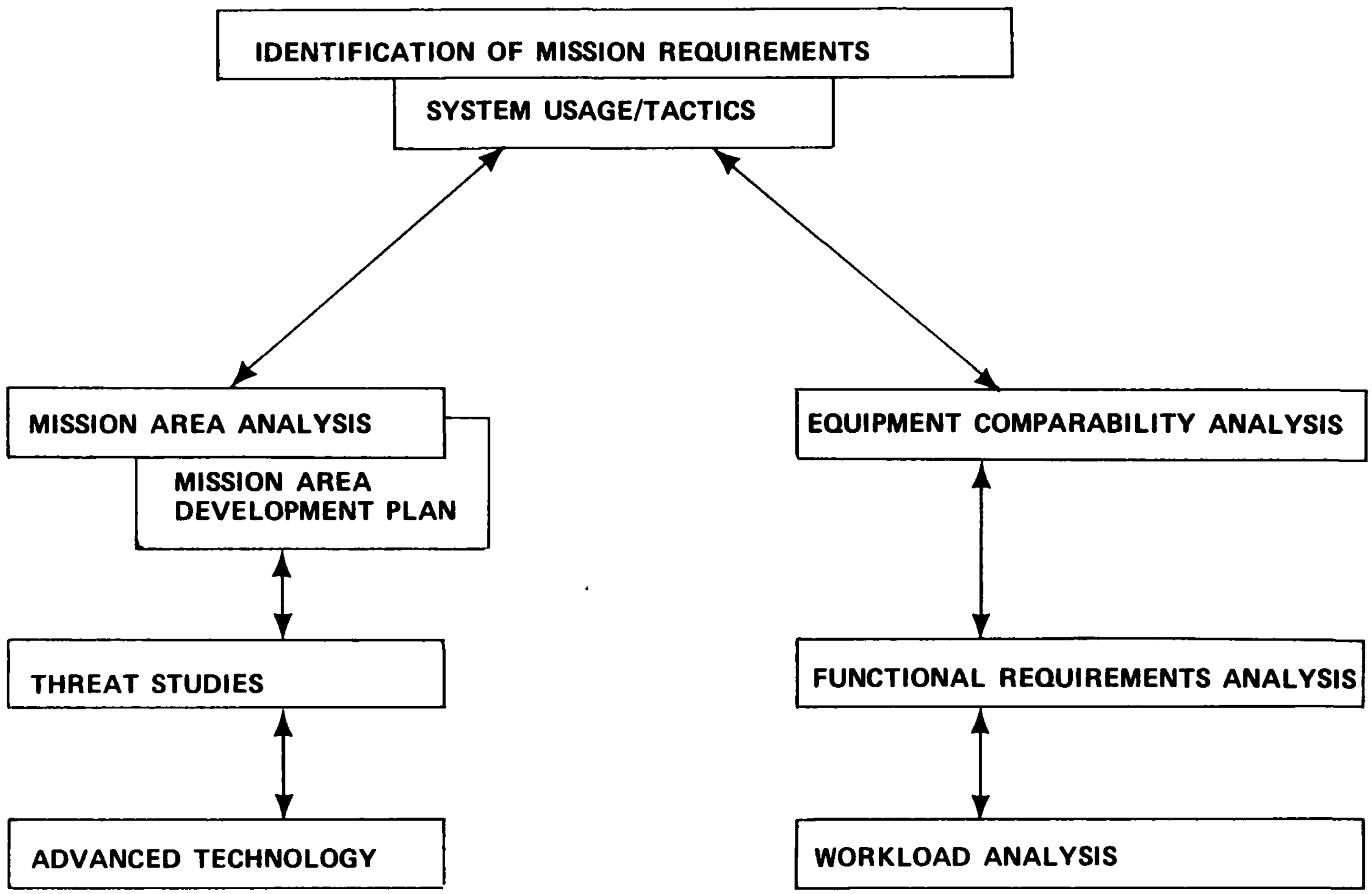
# HOW HARDMAN PRODUCTS SHOULD BE USED

- SOURCE SELECTION AND EVALUATION
- HUMAN RESOURCE – EQUIPMENT DESIGN TRADEOFFS
- UPDATES AND REASSESSMENTS OF O&O PLAN
- INPUTS FOR TRAINING SUPPORT PLAN
- TENTATIVE QQPRI AND BOIP DEVELOPMENT
- INPUTS FOR COEA DEVELOPMENT
- INPUTS FOR ICTP AND IKP
- INPUTS FOR ASARCS

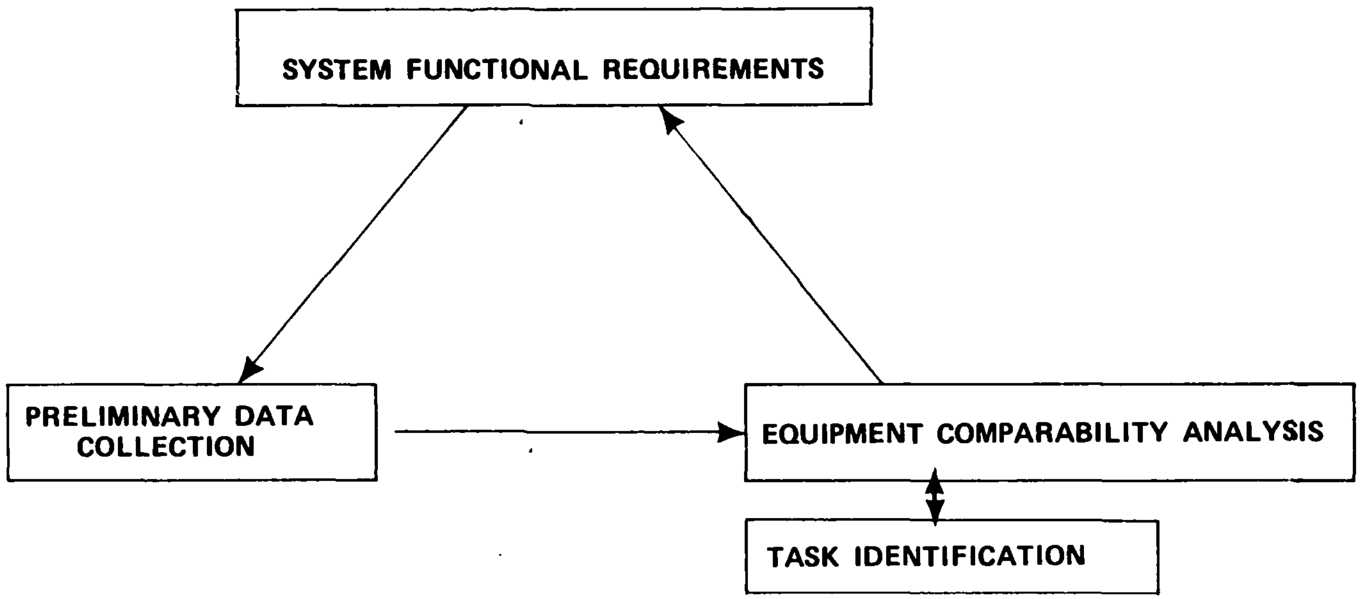
# SYSTEM ANALYSIS

- MISSION ANALYSIS
- FUNCTIONAL REQUIREMENTS ANALYSIS
- EQUIPMENT COMPARABILITY ANALYSIS
- R/M ANALYSIS
- TASK IDENTIFICATION

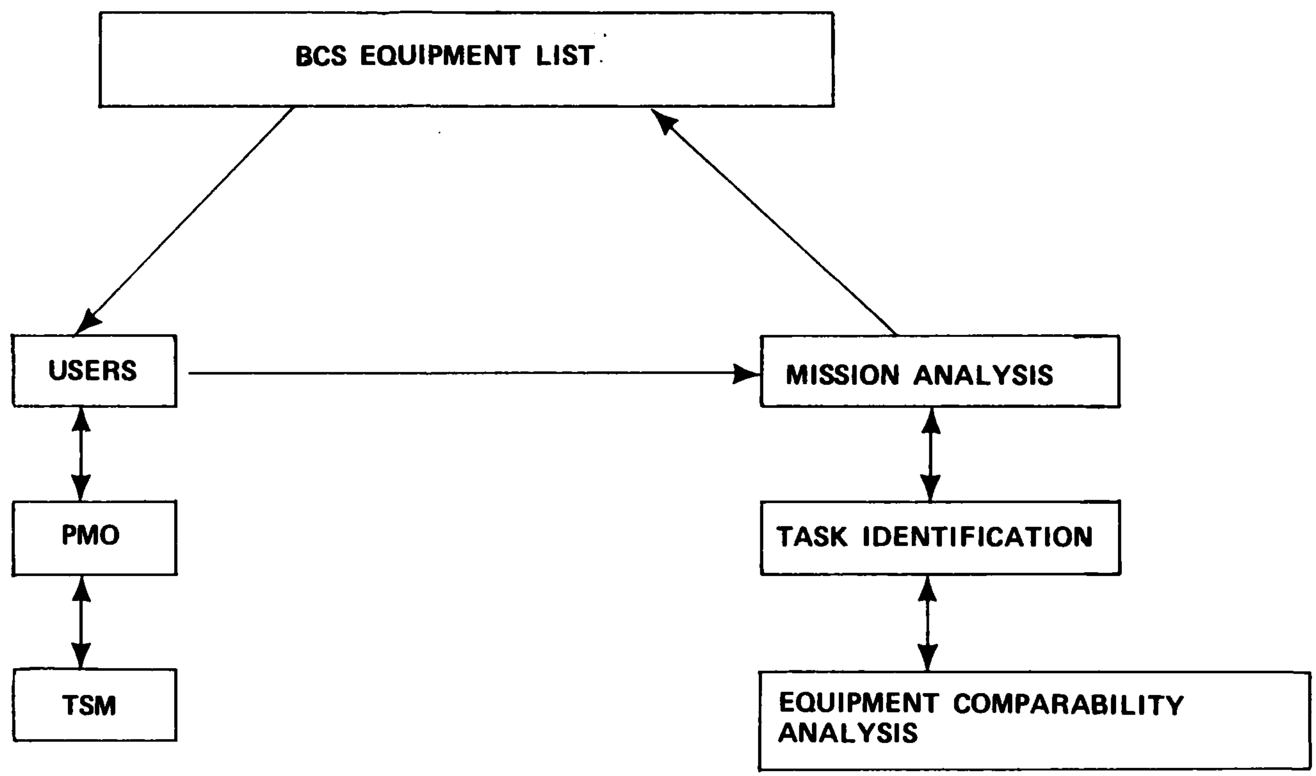
# MISSION ANALYSIS



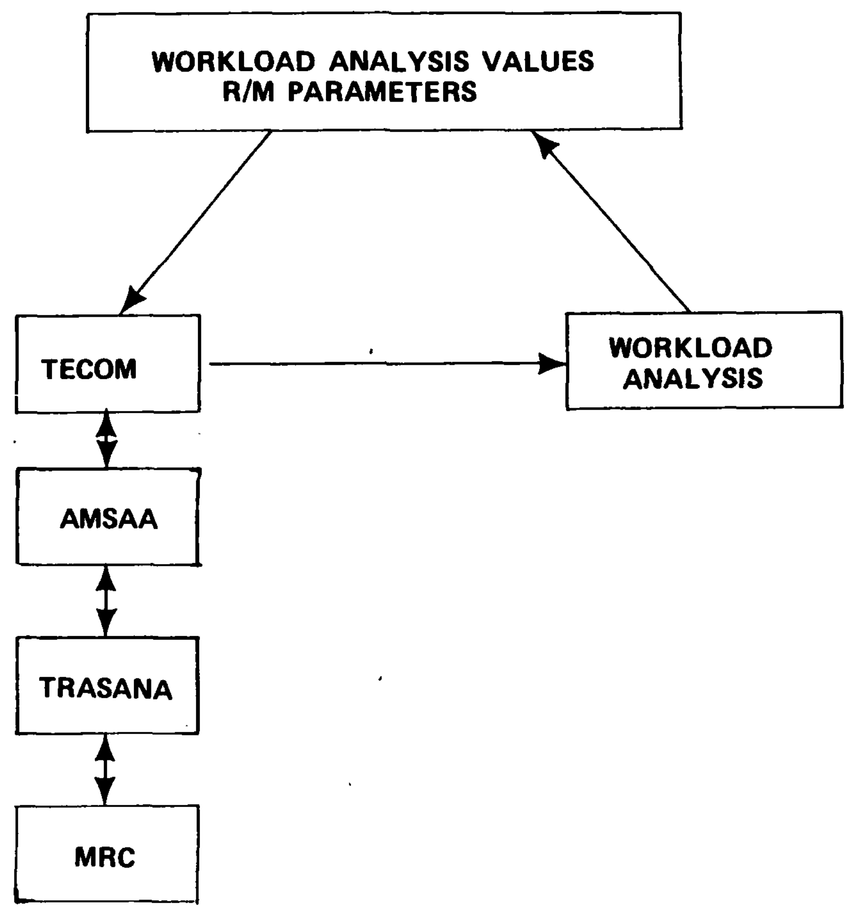
# FUNCTIONAL REQUIREMENTS ANALYSIS



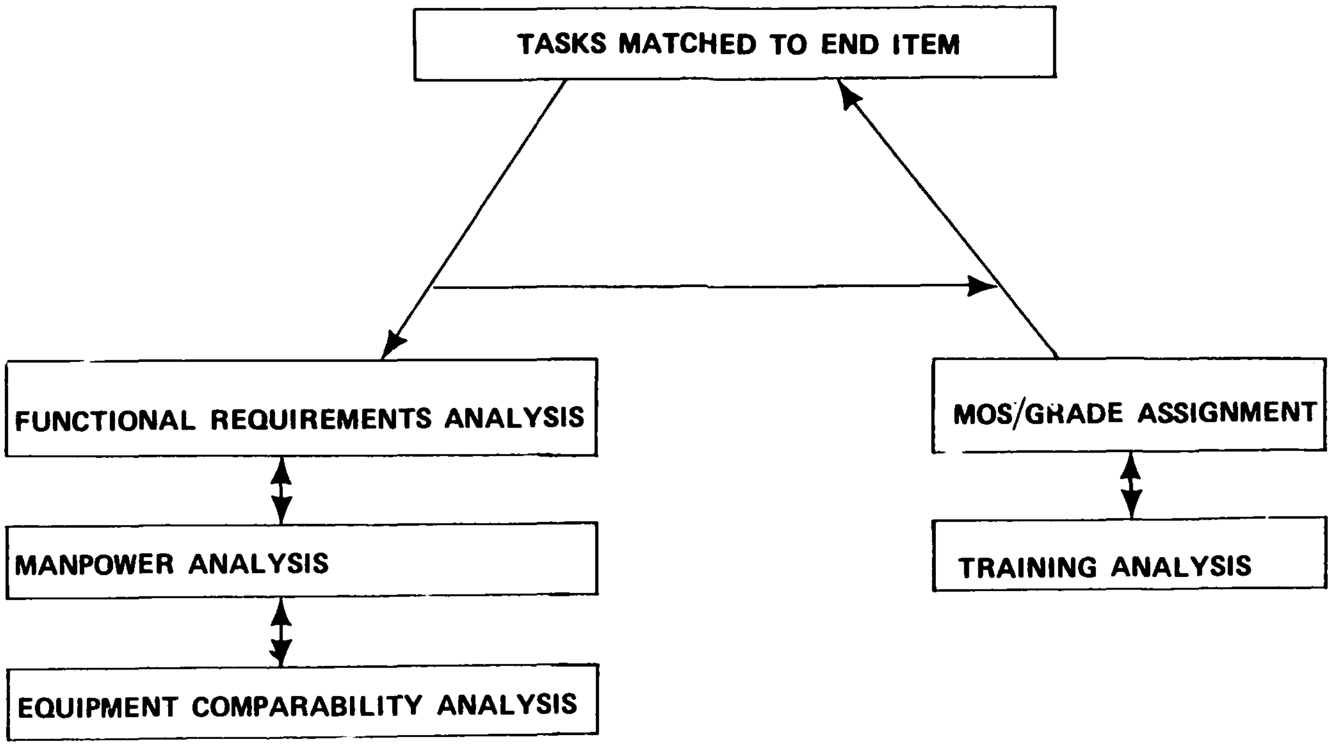
# EQUIPMENT COMPARABILITY ANALYSIS



# RELIABILITY/MAINTAINABILITY ANALYSIS



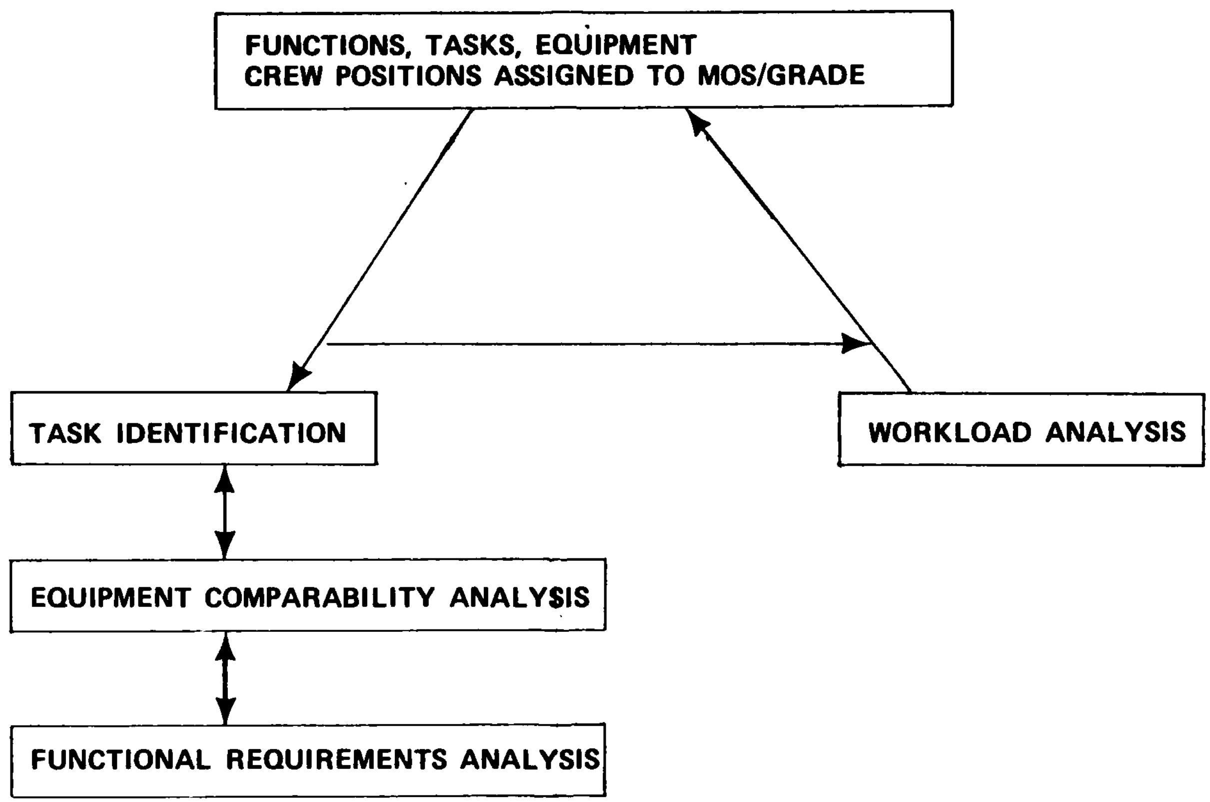
# TASK IDENTIFICATION



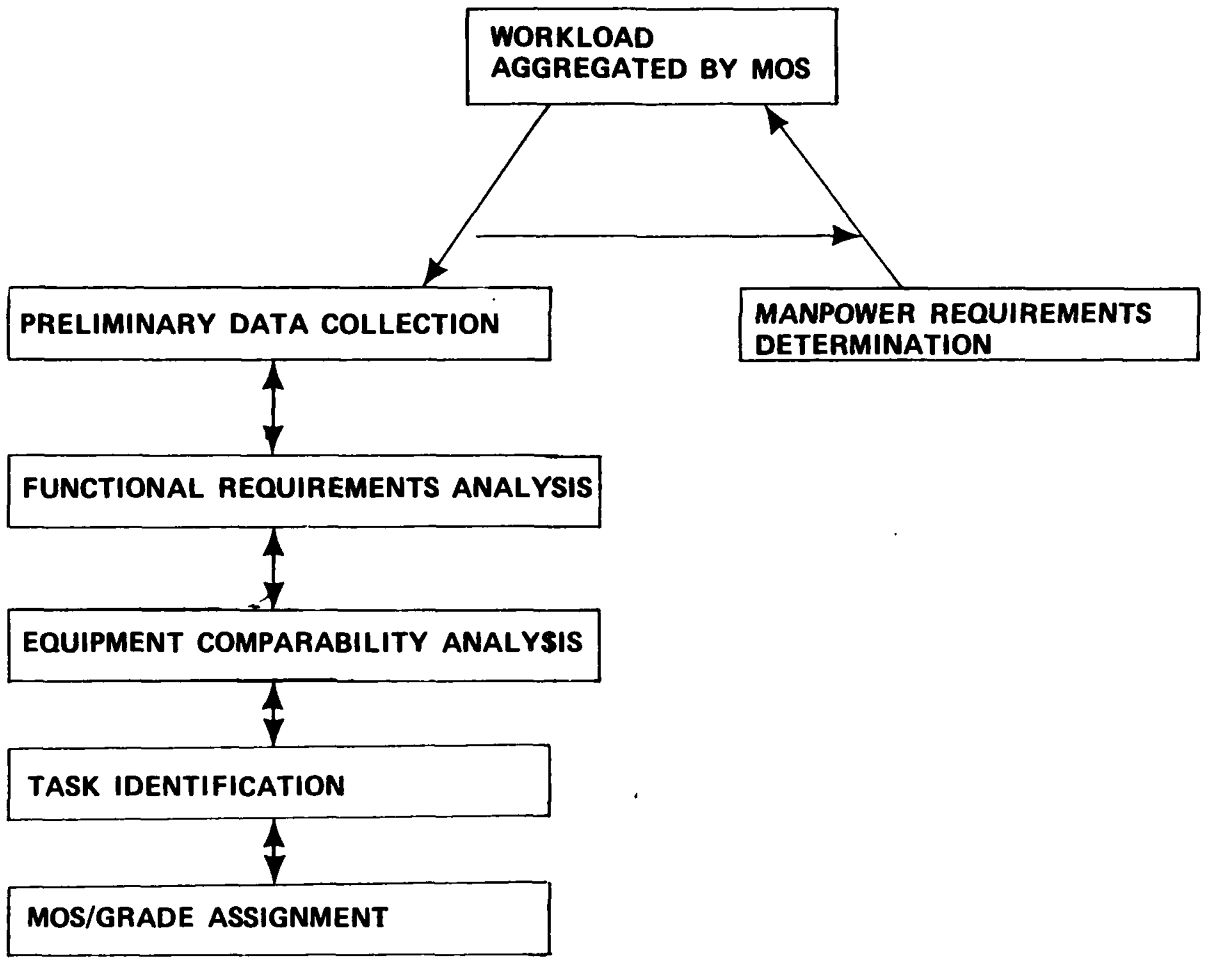
# MANPOWER ANALYSIS

- MOS/GRADE ASSIGNMENT
- WORKLOAD ANALYSIS
- MANPOWER REQUIREMENTS DETERMINATION

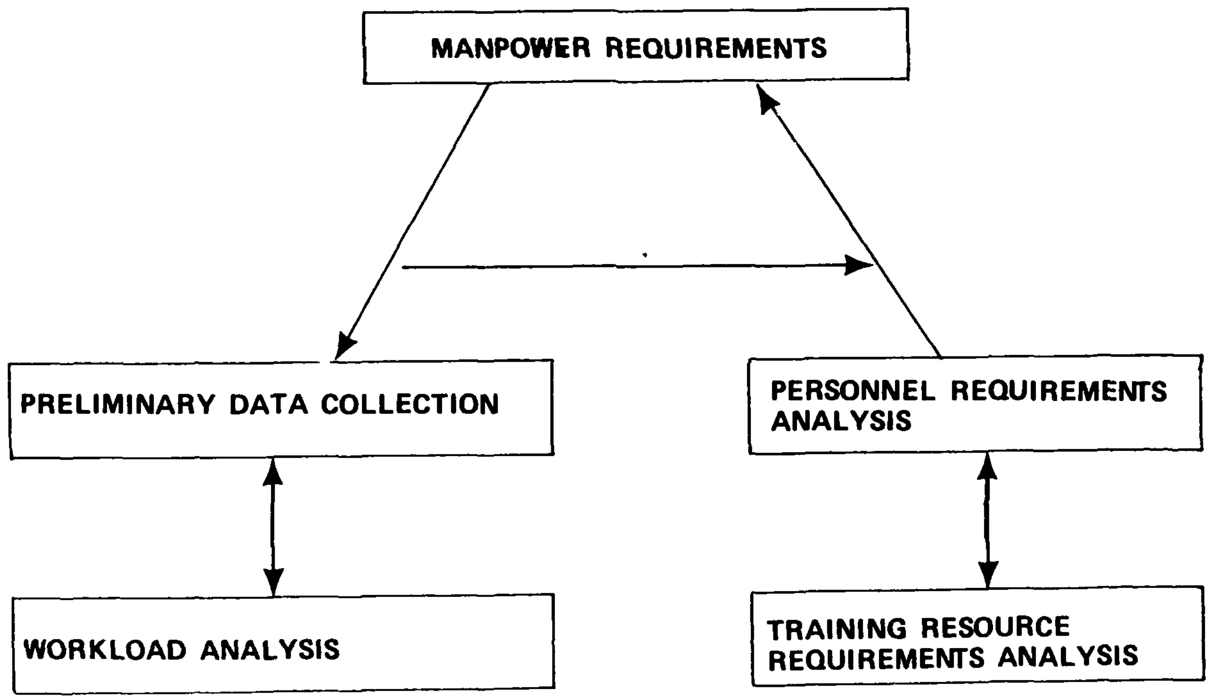
# MOS/GRADE ASSIGNMENT



# WORKLOAD ANALYSIS



# MANPOWER REQUIREMENTS DETERMINATION



# MANPOWER: OPERATOR/CREW REQUIREMENTS
# (SYSTEM DENSITY : 1)

| | | | PROPOSED SYSTEM ALTERNATIVES | | |
|---|---|---|---|---|---|
| MOS | PREDECESSOR* | BCS | ALT 1 | ALT 2 | ALT 3 |
| 13X | 14 | 8 | 7 | 10 | 4 |
| 19V | 10 | 8 | 5 | 4 | 6 |
| TOTAL | 24 | 16 | 12 | 14 | 10 |

* Per TOE

# MANPOWER UNIT MAINTENANCE REQUIREMENTS
# (SYSTEM DENSITY : 24)

| | | | PROPOSED SYSTEM ALTERNATIVES | | |
|---|---|---|---|---|---|
| MOS | PREDECESSOR * | BCS | ALT 1 | ALT 2 | ALT 3 |
| 31V | 0 | 8 | 0 | 2 | 8 |
| 35E | 0 | 16 | 0 | 1 | 1 |
| 45D | 6 | 13 | 16 | 14 | 5 |
| 63D | 6 | 2 | 2 | 4 | 3 |
| 63J | 0 | 1 | 0 | 1 | 1 |
| TOTAL | 12 | 40 | 18 | 22 | 18 |

* Per TOE

# MANPOWER: INTERMEDIATE MAINTENANCE (FORWARD) REQUIREMENTS

| MOS | PREDECESSOR * | BCS | PROPOSED SYSTEM ALTERNATIVES | | |
|---|---|---|---|---|---|
| | | | ALT 1 | ALT 2 | ALT 3 |
| 31E | 9 | 10 | 23 | 10 | 23 |
| 31S | 0 | 0 | 6 | 0 | 6 |
| 34Y | 6 | 0 | 1 | 1 | 1 |
| 35E | 9 | 0 | 27 | 1 | 1 |
| 35H | 0 | 0 | 1 | 0 | 1 |
| 41C | 6 | 5 | 1 | 1 | 1 |
| 44B | 0 | 1 | 1 | 1 | 1 |
| 45B | 3 | 0 | 2 | 2 | 2 |
| 45L | 15 | 65 | 65 | 65 | 10 |
| 63G | 9 | 1 | 1 | 1 | 1 |
| 63H | 42 | 1 | 1 | 8 | 5 |
| 63J | 3 | 0 | 3 | 1 | 3 |
| TOTAL | 102 | 83 | 132 | 91 | 55 |

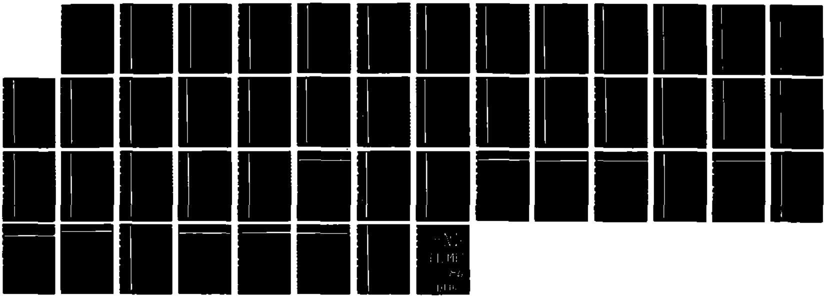
* Per TOE
Values include support for other LINs

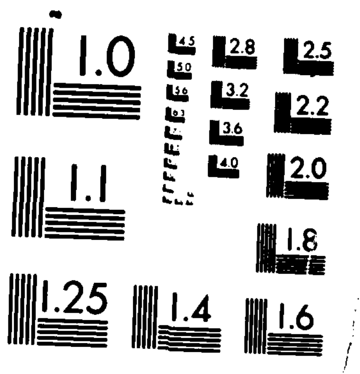
# MANPOWER: FORCE STRUCTURE SUMMARY

| LEVEL | BASIS | PREDECESSOR | BCS | Proposed System Alternatives ALT 1 | ALT 2 | ALT 3 |
|---|---|---|---|---|---|---|
| Company | 8 Crews | 72 | 56 | 120 | 96 | 56 |
| Battalion | 24 Crews | 216 | 168 | 360 | 288 | 168 |
| | 1 Unit Maintenance | 12 | 40 | 18 | 22 | 18 |
| | TOTAL BATTALION | 228 | 208 | 378 | 310 | 186 |
| Division | 72 Crews | 648 | 504 | 1080 | 864 | 504 |
| | 3 Unit Maintenance | 36 | 120 | 54 | 66 | 54 |
| | 1 IMA - Forward | 102 | 132 | 83 | 91 | 55 |
| | TOTAL DIVISION | 786 | 756 | 1217 | 1021 | 613 |

AD-A164 628 ARMY HARDMAN FAMILIARIZATION REPORT(U) DYNAMICS RESEARCH CORP WILMINGTON MA R B WESSLING ET AL. JAN 85 E-9743U DABT60-84-C-0077 4/4

UNCLASSIFIED F/G 5/1 NL






MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

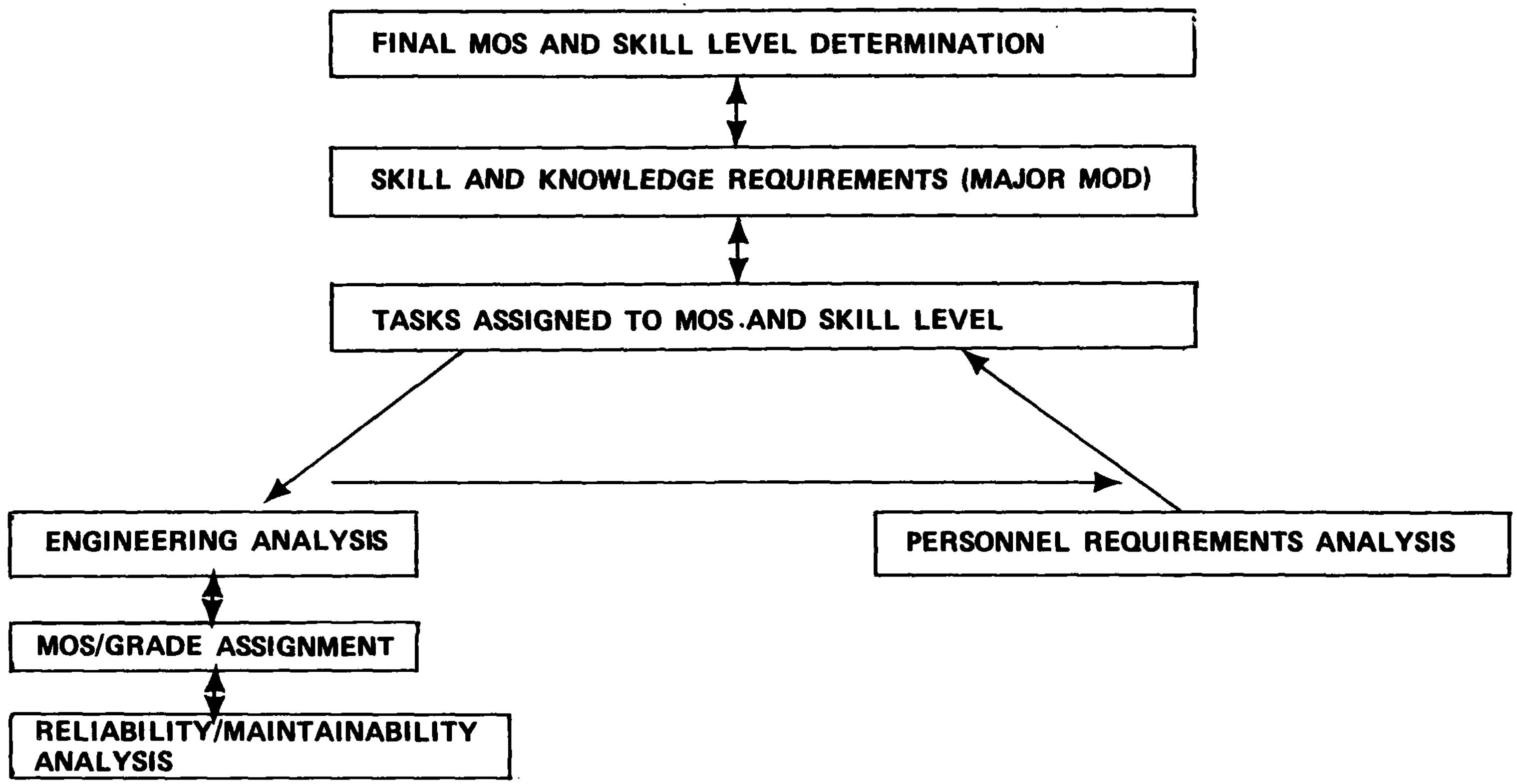
# MANPOWER: TOTAL REQUIREMENT
# (SYSTEM DENSITY : 848)

| | | | Proposed System Alternatives | | |
|---|---|---|---|---|---|
| MOS | PREDECESSOR | BCS | ALT 1 | ALT 2 | ALT 3 |
| 13B | 8,820 | 5,936 | 12,720 | 10,176 | 5,936 |
| 31E | 2 | 456 | 120 | 120 | 456 |
| 31S | 0 | 72 | 0 | 0 | 72 |
| 31V | 0 | 282 | 0 | 0 | 282 |
| 32G | 0 | 96 | 0 | 70 | 96 |
| 34Y | 0 | 24 | 0 | 24 | 24 |
| 35C | 0 | 192 | 0 | 12 | 12 |
| 35E | 0 | 324 | 0 | 12 | 12 |
| 35H | 0 | 12 | 0 | 0 | 12 |
| 41C | 15 | 120 | 432 | 36 | 36t |
| 44B | 0 | 24 | 24 | 24 | 24 |
| 45B | 7 | 24 | 0 | 24 | 24 |
| 45D | 343 | 459 | 565 | 494 | 176 |
| 45L | 244 | 1,548 | 1,548 | 1,548 | 216 |
| 63D | 518 | 70 | 70 | 141 | 105 |
| 63G | 0 | 24 | 24 | 24 | 24 |
| 63H | 357 | 72 | 72 | 165 | 120 |
| 63J | 0 | 71 | 0 | 47 | 71 |
| TOTAL | 10,306 | 9,806 | 15,575 | 12,908 | 7,698 |

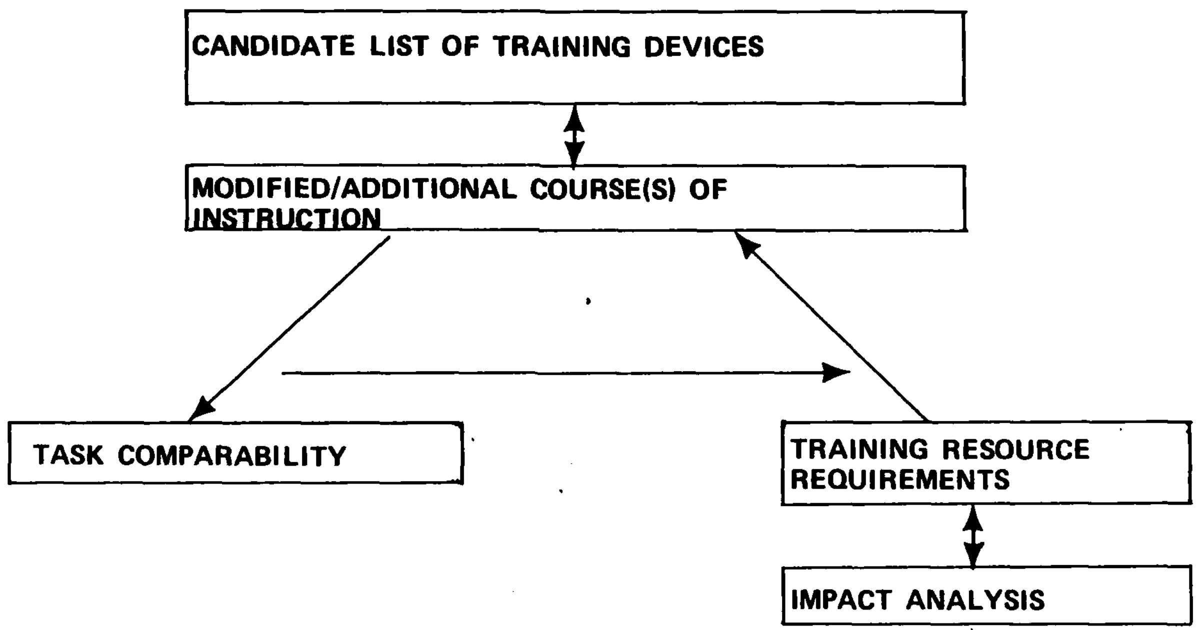
# TRAINING RESOURCE REQUIREMENTS ANALYSIS

- TASK COMPARABILITY
- COURSE REQUIREMENTS
- TRAINING RESOURCE REQUIREMENTS

# TASK COMPARABILITY



# COURSE REQUIREMENTS



# TRAINING: ANNUAL MAN-DAY REQUIREMENTS

## (IN THOUSANDS OF MAN-DAYS)

| | | | Proposed System Alternatives | | |
|---|---|---|---|---|---|
| MOS | PREDECESSOR | BCS | ALT 1 | ALT 2 | ALT 3 |
| 13B | 600.0 | 501.7 | 781.7 | 822.3 | 501.7 |
| 31E | 75.0 | 81.2 | 24.2 | 24.2 | 87.2 |
| 31S | N/A | 10.1 | N/A | N/A | 9.8 |
| 31V | N/A | 27.9 | N/A | 7.1 | 26.2 |
| 32G | N/A | 20.2 | N/A | N/A | 19.8 |
| 34Y | N/A | 5.2 | N/A | 4.9 | 5.2 |
| 35C | N/A | 8.4 | N/A | 1.3 | 1.3 |
| 35E | N/A | 52.9 | N/A | 4.5 | 6.2 |
| 35H | N/A | 3.5 | N/A | N/A | 3.5 |
| 41C | 3.2 | 14.2 | 36.8 | 5.7 | 5.7 |
| 44B | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 |
| 45B | N/A | 1.4 | N/A | 1.4 | 1.4 |
| 45D | 15.0 | 20.9 | 9.7 | 9.7 | 13.3 |
| 45L | 60.0 | 74.8 | 57.2 | 63.1 | 8.9 |
| 63D | 2.2 | 2.2 | 2.2 | 4.5 | 4.5 |
| 63G | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| 63H | 2.9 | 2.9 | 2.9 | 5.7 | 5.7 |
| 63J | N/A | 3.9 | N/A | 3.9 | 3.9 |
| TOTAL | 764.6 | 837.6 | 921 | 964.6 | 709.6 |

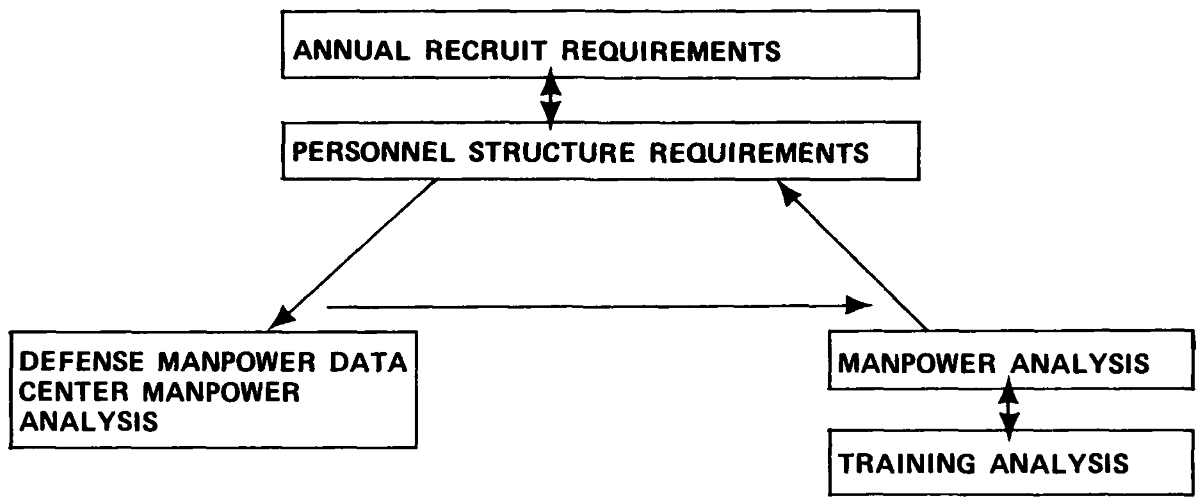
# TRAINING: ANNUAL INSTRUCTOR REQUIREMENT

| MOS | PREDECESSOR | BCS | Proposed System Alternatives: ALT 1 | ALT 2 | ALT 3 |
|---|---|---|---|---|---|
| 13B | 350 | 244 | 374 | 400 | 244 |
| 31E | 75 | 85 | 28 | 28 | 92 |
| 31S | N/A | 13 | N/A | N/A | 13 |
| 31V | N/A | 30 | N/A | 8 | 28 |
| 32G | N/A | 21 | N/A | N/A | 20 |
| 34Y | N/A | 2 | N/A | 2 | 2 |
| 35C | N/A | 14 | N/A | 2 | 2 |
| 35E | N/A | 54 | N/A | 5 | 7 |
| 35H | N/A | 2 | N/A | N/A | 2 |
| 41C | 10 | 15 | 38 | 6 | 6 |
| 44B | 5 | 5 | 5 | 5 | 5 |
| 45B | N/A | 2 | N/A | 2 | 2 |
| 45D | 17 | 35 | 16 | 14 | 23 |
| 45L | 96 | 104 | 91 | 101 | 17 |
| 63D | 1 | 1 | 1 | 3 | 3 |
| 63G | 2 | 2 | 2 | 2 | 2 |
| 63H | 3 | 3 | 3 | 6 | 5 |
| 63J | N/A | 3 | N/A | 3 | 3 |
| TOTAL | 559 | 635 | 558 | 587 | 476 |

# TRAINING: ANNUAL COSTS
# (IN THOUSANDS OF DOLLARS)

| | | | Proposed System Alternatives | | |
|---|---|---|---|---|---|
| MOS | PREDECESSOR | BCS | ALT 1 | ALT 2 | ALT 3 |
| 13B | 97,500 | 68,750 | 101,015 | 104,535 | 68,750 |
| 31E | 3,000 | 13,844 | 4,672 | 4,672 | 14,785 |
| 31S | N/A | 1,491 | N/A | N/A | 1,458 |
| 31V | N/A | 3,914 | N/A | 1,039 | 3;735 |
| 32G | N/A | 2,769 | N/A | N/A | 2,721 |
| 34Y | N/A | 1,005 | N/A | 974 | 1,005 |
| 35C | N/A | 2,570 | N/A | 583 | 583 |
| 35E | N/A | 10,018 | N/A | 1,096 | 1,462 |
| 35H | N/A | 442 | N/A | N/A | 442 |
| 41C | 5,000 | 2,998 | 6,736 | 1,327 | 1,327 |
| 44B | 1,194 | 1,194 | 1,194 | 1,194 | 1,194 |
| 45B | N/A | 377 | N/A | 377 | 377 |
| 45D | 2,235 | 4,009 | 2,235 | 2,181 | 2,806 |
| 45L | 7,500 | 13,415 | 10,814 | 11,801 | 2,228 |
| 63D | 533 | 537 | 533 | 1,014 | 1,014 |
| 63G | 694 | 694 | 694 | 694 | 694 |
| 63H | 1,178 | 1,178 | 1,178 | 2,297 | 1,885 |
| 63J | N/A | 878 | N/A | 878 | 878 |
| TOTAL | 118,834 | 130,083 | 129,071 | 134,662 | 107,344 |

# PERSONNEL REQUIREMENTS ANALYSIS



# PERSONNEL: TOTAL REQUIREMENT

| | | | Proposed System Alternatives | | |
|---|---|---|---|---|---|
| MOS | PREDECESSOR | BCS | ALT 1 | ALT 2 | ALT 3 |
| 13B | 25,500 | 16,712 | 27,731 | 26,766 | 16,712 |
| 31E | 100 | 1,664 | 499 | 499 | 1,664 |
| 31S | N/A | 399 | N/A | N/A | 399 |
| 31V | N/A | 796 | N/A | 198 | 796 |
| 32G | N/A | 527 | N/A | N/A | 527 |
| 34Y | N/A | 82 | N/A | 82 | 82 |
| 35C | N/A | 379 | N/A | 46 | 46 |
| 35E | N/A | 1,244 | N/A | 109 | 146 |
| 35H | N/A | 40 | N/A | - | 40 |
| 41C | 125 | 333 | 865 | 133 | 133 |
| 44B | 70 | 70 | 70 | 70 | 70 |
| 45B | 133 | 133 | - | 133 | 133 |
| 45D | 1,200 | 1,806 | 1,004 | 1,003 | 1,157 |
| 45L | 3,500 | 3,005 | 3,005 | 3,005 | 4111 |
| 63D | 46 | 134 | 134 | 307 | 307 |
| 63G | 67 | 67 | 67 | 67 | 67 |
| 63H | 155 | 155 | 155 | 310 | 252 |
| 63J | 304 | 304 | - | 126 | 304 |
| TOTAL | 31,200 | 27,899 | 33,581 | 32,904 | 23,246 |

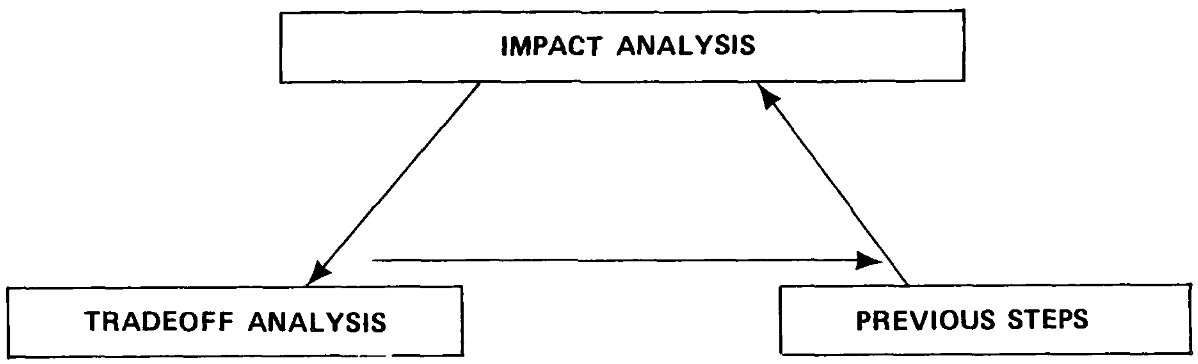
# PERSONNEL: STRUCTURE BY PAYGRADE

| | | | Proposed System Alternatives | | |
|---|---|---|---|---|---|
| PAYGRADE | PREDECESSOR | BCS | ALT 1 | ALT 2 | ALT 3 |
| E-1 | 6,000 | 5,341 | 5,948 | 6,075 | 4,296 |
| E-2 | 4,500 | 4,157 | 4,799 | 4,887 | 3,449 |
| E-3 | 7,000 | 5,690 | 6,643 | 6,785 | 4,673 |
| E-4 | 9,500 | 7,612 | 9,575 | 9,614 | 6,354 |
| E-5 | 2,700 | 3,495 | 3,954 | 3,847 | 2,870 |
| E-61 | 1,500 | 1,604 | 2,662 | 1,696 | 1,604 |
| TOTAL | 31,200 | 27,899 | 33,581 | 32,904 | 23,246 |

# PERSONNEL: ANNUAL RECRUITS

| | | | Proposed System Alternatives | | |
|---|---|---|---|---|---|
| MOS | PREDECESSOR | BCS | ALT 1 | ALT 2 | ALT 3 |
| 13B | 6,000 | 5,658 | 9,388 | 9,388 | 5,648 |
| 31E | 15 | 569 | 171 | 171 | 569 |
| 31S | N/A | 129 | - | - | 129 |
| 31V | N/A | 519 | - | 129 | 519 |
| 32G | N/A | 107 | - | - | 107 |
| 34Y | N/A | 36 | - | 36 | 36 |
| 35C | N/A | 77 | - | 12 | 12 |
| 35E | N/A | 523 | - | 46 | 61 |
| 35H | N/A | 17 | - | - | 17 |
| 41C | 50 | 124 | 322 | 50 | 50 |
| 44B | 62 | 62 | 62 | 62 | 62 |
| 45B | 37 | 37 | - | 37 | 37 |
| 45D | 375 | 660 | 367 | 367 | 423 |
| 45L | 1,200 | 1,132 | 1,132 | 1,132 | 152 |
| 63D | 58 | 58 | 58 | 118 | 118 |
| 63H | 75 | 75 | 75 | 150 | 122 |
| 63J | 89 | 89 | - | 89 | 89 |
| TOTAL | 8,411 | 9,916 | 11,619 | 11,821 | 8,205 |

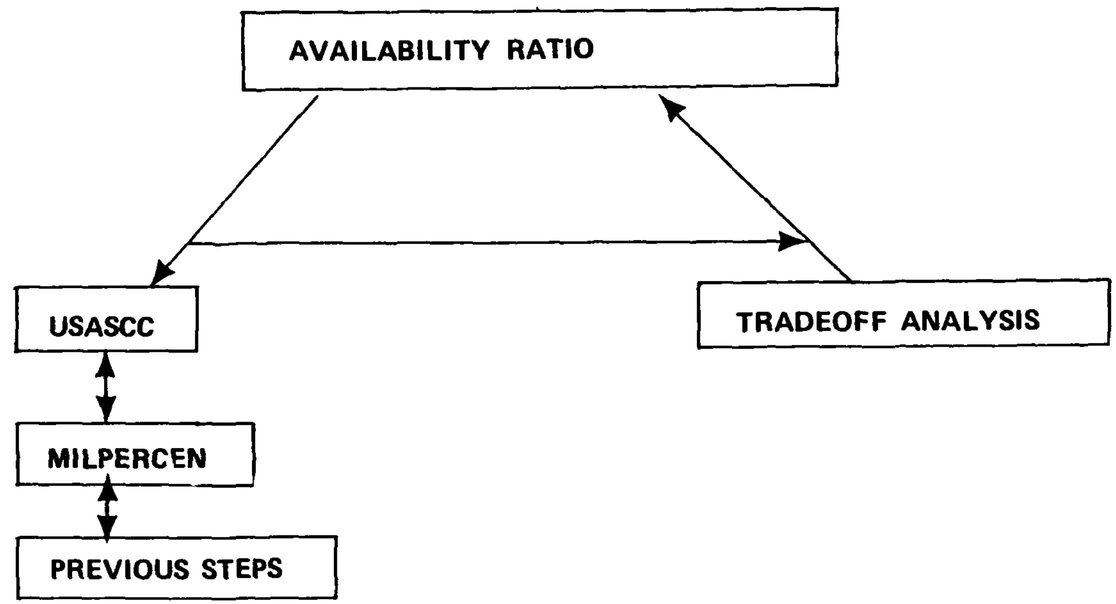
# IMPACT ANALYSIS



# IMPACT: RANKED TOTAL MANPOWER REQUIREMENT

| RANK | PREDECESSOR | | BCS | | ALT 3 | |
|---|---|---|---|---|---|---|
| | MOS | MANPOWER | MOS | MANPOWER | MOS | MANPOWER |
| 1 | 13B | 8820 | 13B | 5936 | 13B | 5936 |
| 2 | 63D | 518 | 45L | 1548 | 31E | 456 |
| 3 | 63H | 357 | 45D | 459 | 31V | 282 |
| 4 | 45D | 343 | 31E | 456 | 45L | 216 |
| 5 | 45L | 244 | 35E | 324 | 45D | 176 |
| 6 | 41C | 15 | 31V | 282 | 63H | 120 |
| 7 | 45B | 7 | 35C | 192 | 63D | 105 |
| 8 | 31E | 2 | 41C | 120 | 32G | 96 |
| 9 | 31S | 0 | 32G | 96 | 31Sq | 72 |
| 10 | 31V | 0 | 31S | 72 | 63J | 71 |
| 11 | 32G | 0 | 63H | 72 | 41C | 36 |
| 12 | 34Y | 0 | 63J | 71 | 34Y | 24 |
| 13 | 35C | 0 | 63D | 70 | 44B | 24 |
| 14 | 35E | 0 | 34Y | 24 | 45B | 24 |
| 15 | 35H | 0 | 44B | 24 | 63G | 24 |
| 16 | 44B | 0 | 45B | 24 | 35C | 12 |
| 17 | 63G | 0 | 63G | 24 | 35E | 12 |
| 18 | 63J | 0 | 35H | 12 | 35H | 12 |

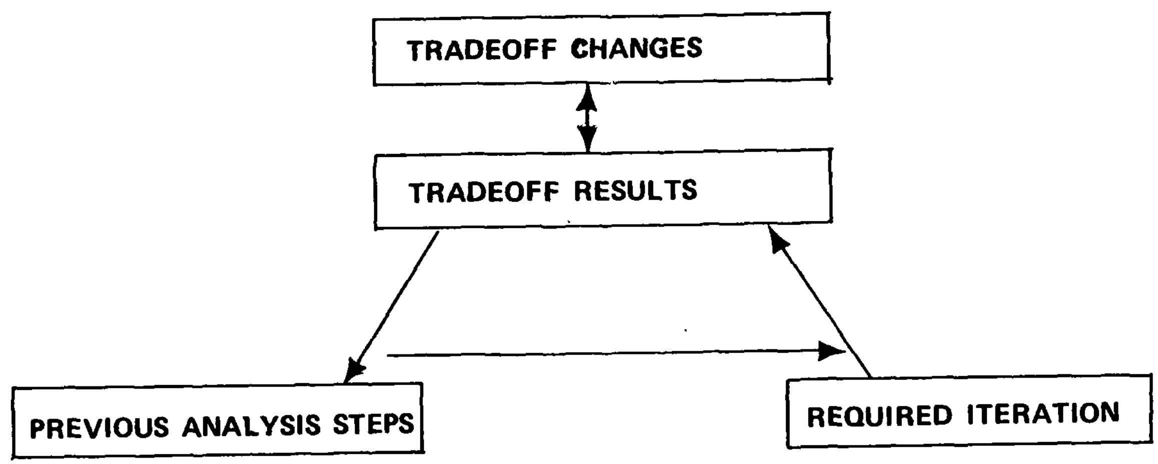
# AVAILABILITY RATIO



# IMPACT: AVAILABILITY RATIO

| | | | Proposed System Alternatives | | |
|---|---|---|---|---|---|
| MOS | CURRENT | BCS | ALT 1 | ALT 2 | ALT 3 |
| 13B | .96 | 1.11 | .81 | .90 | 1.11 |
| 31E | .94 | .76 | .92 | .92 | .76 |
| 31S | 1.25 | 1.09 | - | - | 1.09 |
| 31V | 1.00 | .96 | - | .99 | .96 |
| 32G | .93 | .78 | - | - | .78 |
| 34Y | 1.05 | .99 | - | .99 | .99 |
| 35C | .70 | .45 | - | .67 | .67 |
| 35E | .92 | .40 | - | .86 | .84 |
| 35H | 1.14 | 1.13 | - | - | 1.13 |
| 41C | 1.12 | .90 | .58 | 1.07 | 1.07 |
| 44B | .96 | .95 | .95 | .95 | .95 |
| 45B | 1.05 | .99 | - | .99 | .99 |
| 45D | 1.00 | .40 | .65 | .69 | .62 |
| 45L | .87 | .21 | .21 | .21 | .99 |
| 63D | 1.01 | 1.33 | 1.33 | 1.27 | 1.27 |
| 63G | .98 | .95 | .95 | .95 | .95 |
| 63H | 1.01 | .95 | .95 | .93 | .94 |
| 63J | .81 | .76 | - | .78 | .76 |

# TRADEOFF ANALYSIS



# HARDMAN SUPPORTS:

LOGISTICS SUPPORT ANALYSIS (LSA) (MIL–STD 1388–1A)

TASK 201 = USE STUDY

TASK 203 = COMPARATIVE ANALYSIS

TASK 204 = TECHNOLOGICAL OPPORTUNITIES

TASK 205 = SUPPORTABILITY AND RELATED DESIGN FACTORS

TASK 301 = FUNCTIONAL REQUIREMENTS IDENTIFICATION

TASK 302 = SUPPORT SYSTEM ALTERNATIVES

TASK 303 = ALTERNATIVE EVALUATION AND TRADEOFFS

TASK 401 = TASK ANALYSIS

TASK 402 = EARLY FIELDING ANALYSIS

# HARDMAN SUPPORTS:

INDIVIDUAL AND COLLECTIVE TRAINING PLAN (ICTP) (TRADOC REG. 351–9)

- TRAINING PROGRAM DESCRIPTION
- NEW EQUIPMENT TRAINING REQUIREMENTS
- INSTITUTIONAL COURSES OF INSTRUCTION
- INSTRUCTOR REQUIREMENTS
- *NEW FUNDING REQUIREMENTS*
- TRAINING AIDS/MEDIA REQUIREMENTS
- TRAINING DEVICE REQUIREMENTS

# HARDMAN SUPPORTS:

QUALITATIVE AND QUANTITATIVE PERSONNEL REQUIREMENTS INFORMATION (QQPRI) (AR 71–2)

EQUIPMENT DESCRIPTION

MAINTENANCE MANHOURS

OPERATOR MANPOWER REQUIREMENTS

DUTY POSITIONS, MOS, SKILL LEVEL

DUTIES AND TASKS

TRAINING PLAN

# HARDMAN SUPPORTS:

COST AND TRAINING EFFECTIVENESS ANALYSIS (CTEA) (TRADOC TEA HANDBOOK)

| | |
|---|---|
| ANALYZE HARDWARE | COURSE DESCRIPTION |
| DETERMINE OPERATION TASKS | CHANGES TO CURRENT COSTS |
| DEVELOP SOLDIER CAPABILITIES | STUDENT LOAD PER YEAR |
| ANALYZE SOLDIER–HARDWARE SUBSYSTEM INTERFACE | AVERAGE GRADE PER STUDENT |
| ESTIMATED COST | STUDENT SOURCE |
| COURSES IMPACTED | CLASS FREQUENCY |
| | CLASS LENGTH |
| | INSTRUCTOR REQUIREMENTS |

# HIP CASE STUDY

| | |
|---|---|
| • SYSTEM ANALYSIS | STEP 1 |
| • MANPOWER ANALYSIS | STEP 2 |
| • TRAINING ANALYSIS | STEP 3 |
| • PERSONNEL ANALYSIS | STEP 4 |
| • IMPACT ANALYSIS | STEP 5 |
| • TRADEOFF ANALYSIS | STEP 6 |

# SYSTEMS ANALYSIS

- COMPARABILITY ANALYSIS
- EQUIPMENT
- SCENARIO ASSUMPTIONS
  - FORCE STRUCTURE
  - BASIS OF ISSUE

# THE BASIC APPROACH

DATA COLLECTION PLAN

| DEFINE PREDECESSOR SYSTEM | DEFINE PROPOSED SYSTEM(S) | DEFINE BASELINE COMPARISON SYSTEM | COLLECT DATA | DETERMINE REQUIREMENTS |
|---|---|---|---|---|
| • O/O PLAN<br>• DOCTRINE/TACTICS<br>• TRAINING PLANS PROGRAMS & PRODUCTS<br>• ORGANIZATIONAL CONSIDERATIONS<br>• LOGISTICS PLANS<br>• SUPPORTABILITY ISSUES<br>• TECHNICAL MANUALS | • MISSION AREA ANALYSIS<br>• TECHNOLOGY BASE STUDIES<br>• REQUIREMENTS DOCUMENTS<br>• CONTRACTOR STUDIES/PROPOSALS | • MISSION AREA ANALYSIS<br>• DoD/NATO INVENTORY | • HISTORICAL MAINTENANCE DATA<br>– NAVY: 3M<br>– AF: 66-1<br>– ARMY: SDC<br>• OPERATOR/CREW | • PROPOSED SYSTEM<br>REQ = f (Δ, BCS, DATA) |

# HIP EQUIPMENT COMPARABILITY ANALYSIS

DEFINE PROPOSED SYSTEM → DEFINE BASELINE COMPARISON SYSTEM → COLLECT DATA → IDENTIFY DESIGN DIFFERENCES

**DEFINE PROPOSED SYSTEM**

- FIRE SUPPORT MAA
- HIP MSRS
- HIP O&O
- DSWS/ESPAWS STUDIES

**DEFINE BASELINE COMPARISON SYSTEM**

- M109 A2/A3 (PREDECESSOR)
- USN/USAF EQUIPMENTS
- OTHER EXISTING EQUIPMENT

**COLLECT DATA**

- SAMPLE DATA COLLECTION
- NORDEN LSAR
- ARI HOWITZER CREW MODEL

**IDENTIFY DESIGN DIFFERENCES**

- ARMAMENT
- FIRE CONTPOL
- COMMUNICATIONS
- HYDRAULICS
- ELECTRICAL
- AMMUNITION LOADING
- SUSPENSION
- STE/ICE

# SCENARIO ASSUMPTIONS

- WARTIME ONLY
- BASED ON HIP O&O
- 24 HOURS/DAY FOR 7 DAYS
- 372 ROUNDS/TUBE/DAY (COMPOSITE OF SURGE, INTENSE AND SUSTAINED RATES)
- 28 MILES/SPH/DAY
  - 13 FOR TACTICAL POSITIONING
  - 15 FOR UNIT MOVES
- 24 HOURS ON–TIME FOR ELECTRONICS

# FORCE STRUCTURE/BASIS OF ISSUE ASSUMPTIONS

- 8 SPH PER BATTERY
- 3 BATTERIES PER BATTALION
- 3 BATTALIONS PER DIVISION

# MANPOWER RESULTS

- MANPOWER – CREW
- MANPOWER – UNIT MAINTENANCE
- MANPOWER – INTERMEDIATE MAINTENANCE FORWARD
- MANPOWER – FORCE STRUCTURE SUMMARIES
- MANPOWER –ALL MOSs BY DESIGN/SCENARIO

# MANPOWER: CREW

| | CURRENT TOE* | SYSTEM ALTERNATIVES | | |
|---|---|---|---|---|
| | | BCS | HELP | HIP |
| SUSTAINED REQUIREMENT (1 SPH) | 9 | 7 | 12 | 7 |
| BATTERY REQUIREMENT (1 x 8 SPH) | 72 | 56 | 96 | 56 |
| BATTALION REQUIREMENT (3 x 8 SPH) | 216 | 168 | 288 | 168 |

*FA BN, HVY DIV, TOE 06365J210
MODIFIED BY TRADOC
VALUES ARE M109-SPECIFIC

# MANPOWER: UNIT MAINTENANCE
# (24 SPH)

| MOS | CURRENT TOE* | SYSTEM ALTERNATIVES | | |
|---|---|---|---|---|
| | | BCS | HELP | HIP |
| 31V | 0 | 8 | 2 | 8 |
| 35E | 0 | 16 | 1 | 1 |
| 45D | 6 | 13 | 14 | 5 |
| 63D | 6 | 2 | 4 | 3 |
| 63J | 0 | 1 | 1 | 1 |
| TOTAL | 12 | 40 | 22 | 18 |

* FA BN, HVY DIV, TOE 06365J210
VALUES ARE M109-SPECIFIC

# MANPOWER: INTERMEDIATE MAINTENANCE - FORWARD (72 SPH)

| MOS | CURRENT TOE* | SYSTEM ALTERNATIVES | | |
|---|---|---|---|---|
| | | BCS | HELP | HIP |
| 31E | 9 | 23 | 10 | 23 |
| 31S | 0 | 6 | 0 | 6 |
| 34Y | 6 | 1 | 1 | 1 |
| 35E | 9 | 27 | 1 | 1 |
| 35H | 0 | 1 | 0 | 1 |
| 41C | 6 | 1 | 1 | 1 |
| 44B | 0 | 1 | 1 | 1 |
| 45B | 3 | 2 | 2 | 2 |
| 45L | 15 | 65 | 65 | 10 |
| 63G | 9 | 1 | 1 | 1 |
| 63H | 42 | 1 | 8 | 5 |
| 63J | 3 | 3 | 1 | 3 |
| TOTAL | 102 | 132 | 91 | 55 |

*MAINT CO, FWD SPT BN, HVY DIV
TOE 43004J200
VALUES INCLUDE SUPPORT FOR OTHER LINs

# MANPOWER: FORCE STRUCTURE SUMMARIES

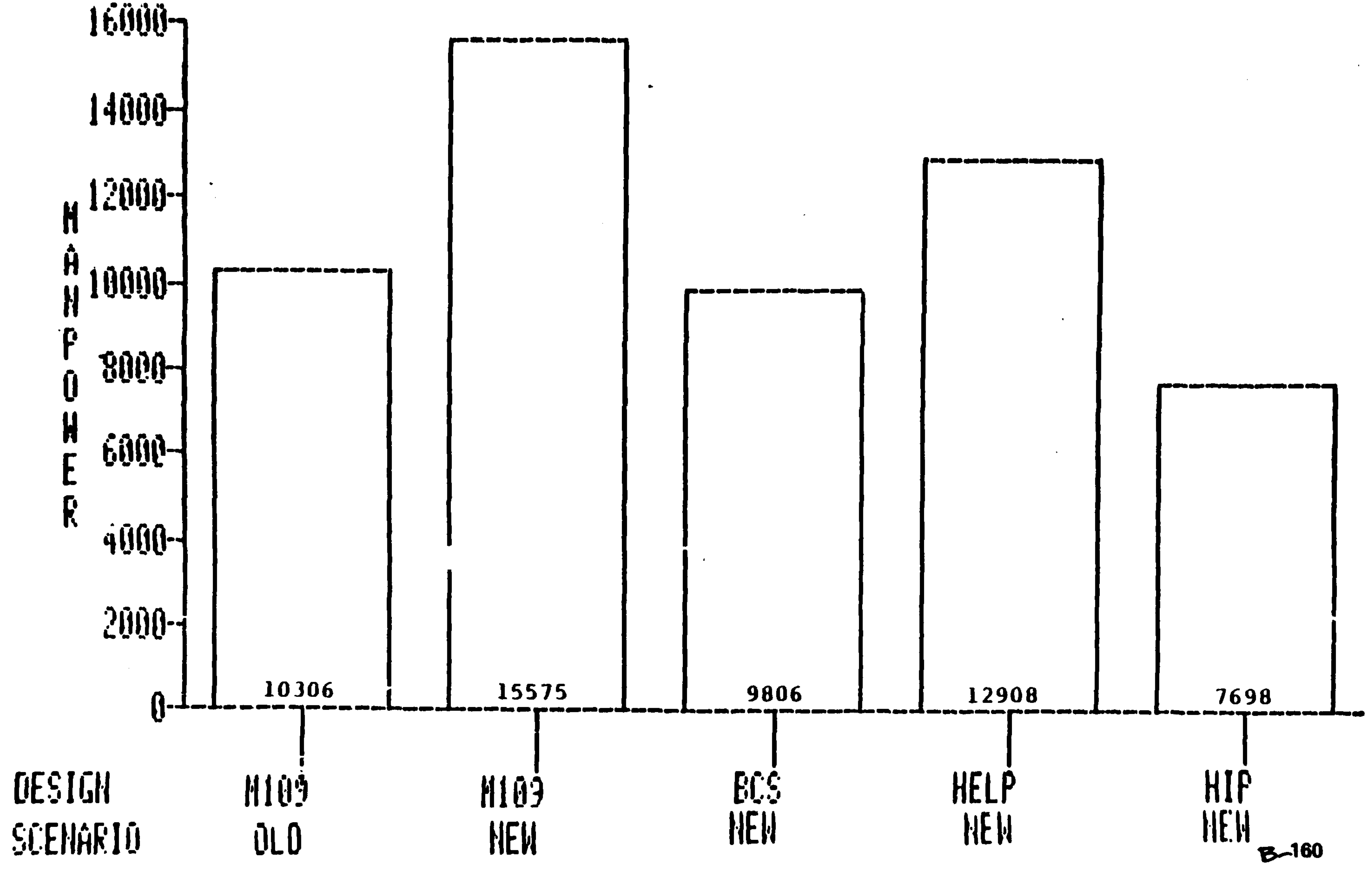
| LEVEL | BASIS | CURRENT TOE* | SYSTEM ALTERNATIVES BCS | HELP | HIP |
|---|---|---|---|---|---|
| BATTERY | 8 CREWS | 72 | 56 | 96 | 56 |
| BATTALION | 24 CREWS | 216 | 168 | 288 | 168 |
| | 1 UNIT MAINTENANCE | 12 | 40 | 22 | 18 |
| | TOTAL BATTALION | 228 | 208 | 310 | 186 |
| DIVISION | 72 CREWS | 648 | 504 | 864 | 504 |
| | 3 UNIT MAINTENANCE | 36 | 120 | 66 | 54 |
| | 1 IMA-FORWARD | 102 | 132 | 91 | 55 |
| | TOTAL DIVISION | 786 | 756 | 1021 | 613 |

*FA BN, HVY DIV, TOE 06365J210
MODIFIED BY TRADOC

# MANPOWER: TOTAL REQUIREMENT (848 SPH)

| MOS | CURRENT AUTHORIZATIONS | SYSTEM ALTERNATIVES BCS | HELP | HIP ½ |
|---|---|---|---|---|
| 13B | 8,820 | 5,936 | 10,176 | 5,936 |
| 31E | 2 | 456 | 120 | 456 |
| 31S | 0 | 72 | 0 | 72 |
| 31V | 0 | 282 | 70 | 282 |
| 32G | 0 | 96 | 0 | 96 |
| 34Y | 0 | 24 | 24 | 24 |
| 35C | 0 | 192 | 12 | 12 |
| 35E | 0 | 324 | 12 | 12 |
| 35H | 0 | 12 | 0 | 12 |
| 41C | 15 | 120 | 36 | 36 |
| 44B | 0 | 24 | 24 | 24 |
| 45B | 7 | 24 | 24 | 24 |
| 45D | 343 | 459 | 494 | 176 |
| 45L | 244 | 1,548 | 1,548 | 216 |
| 63D | 518 | 70 | 141 | 105 |
| 63G | 0 | 24 | 24 | 24 |
| 63H | 357 | 72 | 156 | 120 |
| 63J | 0 | 71 | 47 | 71 |
| TOTAL | 10,306 | 9,806 | 12,908 | 7,698 |

# TOTAL MANPOWER REQUIREMENTS - ALL MOSs



# TRAINING RESULTS

- COURSE IMPACTS MAN–DAYS
- ANNUAL TRAINING MAN–DAY REQUIREMENTS
- ANNUAL INSTRUCTOR REQUIREMENTS
- ANNUAL TRAINING COURSE COSTS/GRADUATE
- ANNUAL TRAINING COST REQUIREMENTS ($K)

# COURSE IMPACTS MAN-DAYS

| MOS | PREDECESSOR | BCS | HELP | HIP |
|---|---|---|---|---|
| 13B | 0 | 5.3 | 4.6 | 5.3 |
| 31E | 0 | 1.7 | 0 | 8.8 |
| 31S | N/A | 3.8 | N/A | 1.9 |
| 31V | N/A | 0.2 | 0.8 | −2.9 |
| 32G | N/A | 5.1 | N/A | 1.5 |
| 34Y | N/A | 8.9 | 6.8 | 8.9 |
| 35C | N/A | 0 | 0 | 0 |
| 35E | N/A | 9.7 | 6.1 | 9.7 |
| 35H | N/A | 0 | N/A | 0 |
| 41C | 0 | 0 | 0 | 0 |
| 44B | 0 | 0 | 0 | 0 |
| 45B | N/A | 0 | 0 | 0 |
| 45D | 0 | 5.6 | 0 | 5.6 |
| 45L | 0 | 15.1 | 5.1 | 8.5 |
| 63D | 0 | 0.6 | 0.6 | 0.6 |
| 63G | 0 | 0 | 0 | 0 |
| 63H | 0 | 0 | 0 | 0 |
| 63J | N/A | 0 | 0 | 0 |
| TOTAL | 0 | 56.0 | 24.0 | 47.9 |

# ANNUAL TRAINING MAN-DAY REQUIREMENTS (K)

| MOS | BCS | HELP | HIP |
|---|---|---|---|
| 13B | 501.7 | 822.3 | 501.7 |
| 31E | 81.2 | 24.2 | 87.2 |
| 31S | 10.1 | N/A | 9.8 |
| 31V | 27.9 | 7.1 | 26.2 |
| 32G | 20.2 | N/A | 19.8 |
| 34Y | 5.2 | 4.9 | 5.2 |
| 35C | 8.4 | 1.3 | 1.3 |
| 35E | 52.9 | 4.5 | 6.2 |
| 35H | 3.5 | N/A | 3.5 |
| 41C | 14.2 | 5.7 | 5.7 |
| 44B | 4.3 | 4.3 | 4.3 |
| 45B | 1.4 | 1.4 | 1.4 |
| 45D | 20.8 | 9.7 | 13.3 |
| 45L | 74.8 | 63.1 | 8.9 |
| 63D | 2.2 | 4.5 | 4.5 |
| 63G | 2.0 | 2.0 | 2.0 |
| 63H | 2.9 | 5.7 | 4.7 |
| 63J | 3.9 | 3.9 | 3.9 |
| TOTAL | 837.6 | 964.6 | 709.6 |

# ANNUAL INSTRUCTOR REQUIREMENTS

| MOS | BCS | HELP | HIP |
|---|---|---|---|
| 13B | 244 | 400 | 244 |
| 31E | 85 | 28 | 92 |
| 31S | 13 | N/A | 13 |
| 31V | 30 | 8 | 28 |
| 32G | 21 | N/A | 20 |
| 34Y | 2 | 2 | 2 |
| 35C | 14 | 2 | 2 |
| 35E | 54 | 5 | 7 |
| 35H | 2 | N/A | 2 |
| 41C | 15 | 6 | 6 |
| 44B | 5 | 5 | 5 |
| 45B | 2 | 2 | 2 |
| 45D | 35 | 14 | 23 |
| 45L | 104 | 101 | 17 |
| 63D | 1 | 3 | 3 |
| 63G | 2 | 2 | 2 |
| 63H | 3 | 6 | 5 |
| 63J | 3 | 3 | 3 |
| TOTAL | 635 | 587 | 476 |

# ANNUAL TRAINING COURSE COSTS PER GRADUATE

ALTERNATIVE: HIP
MOS: 13B100SUT

| | OMA | MPA | PA | FHMA | TOTAL |
|---|---|---|---|---|---|
| INSTRUCTIONAL DEPT. | 329 | 2711 | 0 | 0 | 3040 |
| FLYING HOURS | 0 | 0 | 0 | 0 | 0 |
| OTHER | 0 | 0 | 0 | 0 | 0 |
| TROOP SUPPORT | | | | | |
| P8 | 0 | 0 | 0 | 0 | 0 |
| P2 | 0 | 0 | 0 | 0 | 0 |
| AMMUNITION | 0 | 0 | 1437 | 0 | 1437 |
| EQUIPMENT DEPREC | 0 | 0 | 357 | 0 | 357 |
| STUDENT PAY & ALLOW | 0 | 4130 | 0 | 0 | 4130 |
| TRAVEL PAY AT COURSE | 0 | 154 | 0 | 0 | 154 |
| PER DIEM AT COURSE | 0 | 0 | 0 | 0 | 0 |
| TOTAL DIRECT COST | 329 | 6995 | 1794 | 0 | 9118 |
| BASE OPERATIONS | 1847 | 599 | 0 | 0 | 2446 |
| SUPPORT COSTS | | | | | |
| TRAINING AIDS | 75 | 6 | 0 | 0 | 81 |
| OTHER | 230 | 235 | 0 | 38 | 503 |
| TOTAL INDIRECT | 2152 | 840 | 0 | 38 | 3030 |
| TOTAL DIRECT AND INDIRECT COST | 2481 | 7835 | 1794 | 38 | 12148 |

# ANNUAL TRAINING COSTS REQUIREMENTS
## ($K)

| MOS | BCS | HELP | HIP |
|---|---|---|---|
| 13B | 68,750 | 104,535 | 68,750 |
| 31E | 13,844 | 4,672 | 14,785 |
| 31S | 1,491 | N/A | 1,458 |
| 31V | 3,914 | 1,039 | 3,735 |
| 32G | 2,769 | N/A | 2,721 |
| 34Y | 1,005 | 974 | 1,005 |
| 35C | 2,570 | 583 | 583 |
| 35E | 10,018 | 1,096 | 1,462 |
| 35H | 442 | N/A | 442 |
| 41C | 2,998 | 1,327 | 1,327 |
| 44B | 1,194 | 1,194 | 1,194 |
| 45B | 377 | 377 | 377 |
| 45D | 4,009 | 2,181 | 2,806 |
| 45L | 13,415 | 11,801 | 2,228 |
| 63D | 537 | 1,014 | 1,014 |
| 63G | 694 | 694 | 694 |
| 63H | 1,178 | 2,297 | 1,885 |
| 63J | 878 | 878 | 878 |
| TOTAL | 130,083 | 134,662 | 107,344 |

# PERSONNEL RESULTS

- STRUCTURE REQUIREMENTS BY MOS
- ANNUAL RECRUITS

# PERSONNEL: STRUCTURE REQUIREMENTS BY MOS

| MOS | BCS | HELP | HIP |
|---|---|---|---|
| 13B | 16,712 | 26,766 | 16,712 |
| 31E | 1,664 | 499 | 1,664 |
| 31S | 399 | — | 399 |
| 31V | 796 | 198 | 796 |
| 32G | 527 | — | 527 |
| 34Y | 82 | 82 | 82 |
| 35C | 379 | 46 | 46 |
| 35E | 1,244 | 109 | 146 |
| 35H | 40 | — | 40 |
| 41C | 333 | 133 | 133 |
| 44B | 70 | 70 | 70 |
| 45B | 133 | 133 | 133 |
| 45D | 1,806 | 1,003 | 1,157 |
| 45L | 3,055 | 3,055 | 411 |
| 63D | 134 | 307 | 307 |
| 63G | 67 | 67 | 67 |
| 63H | 155 | 310 | 252 |
| 63J | 304 | 126 | 304 |
| TOTAL | 27,899 | 32,902 | 23,246 |

# ANNUAL RECRUITS

| MOS | BCS | HELP | HIP |
|---|---|---|---|
| 13B | 5,658 | 9,388 | 5,658 |
| 31E | 569 | 171 | 569 |
| 31S | 129 | — | 129 |
| 31V | 519 | 129 | 519 |
| 32G | 107 | — | 107 |
| 34Y | 36 | 36 | 36 |
| 35C | 77 | 12 | 12 |
| 35E | 523 | 46 | 61 |
| 35H | 17 | — | 17 |
| 41C | 124 | 50 | 50 |
| 44B | 62 | 62 | 62 |
| 45B | 37 | 37 | 37 |
| 45D | 660 | 367 | 423 |
| 45L | 1,132 | 1,132 | 152 |
| 63D | 58 | 118 | 118 |
| 63G | 44 | 44 | 44 |
| 63H | 75 | 150 | 122 |
| 63J | 89 | 89 | 89 |
| TOTAL | 9,916 | 11,821 | 8,205 |

# IMPACT RESULTS

- PERSONNEL AVAILABILITY
- M109-DRIVEN
- AVAILABILITY RATIO IMPACTS
  - CURRENT
  - PROJECTED

# PERSONNEL AVAILABILITY
# CURRENT PROJECTIONS FOR 1986

| MOS | AVAILABILITY Total Army | AUTHORIZATIONS Total Army | AVAILABILITY RATIO |
|---|---|---|---|
| 13B | 20,645 | 21,492 | .96 |
| 31E | 1,434 | 1,424 | 1.01 |
| 31S | 640 | 513 | 1.25 |
| 31V | 6,158 | 6,153 | 1.00 |
| 32G | 449 | 481 | .93 |
| 34Y | 369 | 350 | 1.05 |
| 35C | 200 | 285 | .70 |
| 35E | 453 | 494 | .92 |
| 35H | 1,132 | 990 | 1.14 |
| 41C | 491 | 439 | 1.12 |
| 44B | 1,411 | 1,464 | .96 |
| 45B | 502 | 476 | 1.05 |
| 45D | 409 | 408 | 1.00 |
| 45L | 365 | 422 | .87 |
| 63D | 1,879 | 1,863 | 1.01 |
| 63G | 772 | 785 | .98 |
| 63H | 5,183 | 5,753 | 1.01 |
| 63J | 885 | 1,087 | .81 |

Source: -MILPERCEN $P^3M$ Model.

# M109-DRIVEN AUTHORIZATIONS

| MOS | FY 1986 AUTHORIZATIONS TOTAL | M109 | % of TOTAL |
|---|---|---|---|
| 13B | 21,492 | 8,820 | 41 |
| 31E | 1,424 | 2 | — |
| 31S | 513 | 0 | — |
| 31V | 6,153 | 0 | — |
| 32G | 481 | 0 | — |
| 34Y | 350 | 0 | — |
| 35C | 285 | 0 | — |
| 35E | 494 | 0 | — |
| 35H | 990 | 0 | — |
| 41C | 439 | 15 | 3 |
| 44B | 1,464 | 0 | — |
| 45B | 476 | 7 | 1 |
| 45D | 408 | 343 | 84 |
| 45L | 422 | 244 | 58 |
| 63D | 1,863 | 518 | 28 |
| 63G | 785 | 0 | — |
| 63H | 5,753 | 357 | 6 |
| 63J | 1,087 | 0 | — |

# AVAILABILITY RATIO IMPACTS

| MOS | CURRENT | PROJECTED BCS | HELP | HIP |
|---|---|---|---|---|
| 13B | .96 | 1.11 | .90 | 1.11 |
| 31E | .94 | .76 | .92 | .76 |
| 31S | 1.25 | 1.09 | — | 1.09 |
| 31V | 1.00 | .96 | .99 | .96 |
| 32G | .93 | .78 | — | .78 |
| 34Y | 1.05 | .99 | .99 | .99 |
| 35C | .70 | .45 | .67 | .67 |
| 35E | .92 | .40 | .86 | .84 |
| 35H | 1.14 | 1.13 | — | 1.13 |
| 41C | 1.12 | .90 | 1.07 | 1.07 |
| 44B | .96 | .95 | .95 | .95 |
| 45B | 1.05 | .99 | .99 | .99 |
| 45D | 1.00 | .40 | .69 | 1.70 |
| 45L | .87 | .21 | .21 | .99 |
| 63D | 1.01 | 1.33 | 1.27 | 1.27 |
| 63G | .98 | .95 | .95 | .95 |
| 63H | 1.01 | .95 | .93 | .94 |
| 63J | .81 | .76 | .78 | .76 |

# TRADEOFF ANALYSIS

**CONCEPT**

INTERNAL SECURITY

- GIVEN A 12 HOUR OPERATING SCENARIO WORKLOAD REQUIREMENTS PRECLUDE INTERNAL SECURITY GUARDS BEING PROVIDED FROM RPV SECTION PERSONNEL.

**EQUIPMENT**

800 SERIES VERSUS 900 SERIES TRUCK

- THE SAME MAINTENANCE MANPOWER REQUIREMENTS EXIST REGARDLESS OF THE SERIES TRUCK FIELDED AT IOC.

**OPERATIONS**

SITE DISPLACEMENT TIME

- 54 MINUTES IS REQUIRED FOR 13 PERSONNEL TO DISPLACE THE MINIMUM-OPERATIONS RPV SITE.
- 114-120 MINUTES IS REQUIRED FOR 13 PERSONNEL TO DISPLACE THE 100% IMPROVED RPV SITE.

END
FILMED

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